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ABSTRACT

This publication presents insights and instructional ideas to aid teachers of health, physical education, and recreation in developing student reading abilities. Informal diagnostic techniques such as the Cloze procedure, group reading inventory, and teacher-formulated tests are explained. An inventory for assessing student attitudes and interests is suggested. Also described are techniques to overcome difficulties with technical vocabulary, including identifying and preteaching difficult words, developing the use of context clues, and providing adequate reinforcement through word games and crossword puzzles. The reading comprehension process is explored, and practical applications of word association tasks and classification activities are outlined. A section on developing study skills treats difficulties in following directions, interpreting visual aids such as graphs, charts, and diagrams, and applying sound study techniques. Criteria used in selecting instructional materials are discussed, taking into consideration the difficulty level, interests, and suitability for students. Sources of free and inexpensive materials are listed. (FG)

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reading in health/physical education/ recreation classes

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by
Page S. Bristow
Alan E. Farstrup
Health Education Consultant: Ann E. Nolte
Physical Education Consultant: Barbara D. Lockhart
Recreation Education Consultant: Joel F. Meier

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Series Editor
Alfred J. Ciani

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Page S. Bristow

Alan E. Farstrup

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The Authors

Page S. Bristow and **Alan E. Farstrup**
are Assistant Professors in the Education Department,
University of Rhode Island.

The Consultants

The Health Education Consultant,
Ann E. Nolte, is Professor, Health Education,
Illinois State University, Normal.

The Physical Education Consultant,
Barbara D. Lockhart,
is Assistant Dean,
College of HPERD,
Temple University, Philadelphia, Pennsylvania.

The Recreation Education Consultant,
Joel F. Meier, is Professor of Recreation Management,
School of Forestry, University of Montana.

The Series Editor

Alfred J. Ciani is Associate Professor of Education
in the Department of Curriculum and Instruction
at the University of Cincinnati, Ohio.

INTRODUCTION

There was a time when the objective of the childhood game of musical chairs was to be the only person left sitting on a chair. Times have changed. With the New Games Concept, the objective of musical chairs is to get as many persons as possible onto *one* chair. In this manner, no one loses, everyone has fun and the negative effects of competition are eliminated.

This increased consciousness has affected all the aspects in the Health, Physical Education, and Recreation areas. Some large corporations are now providing jogging tracks and exercise rooms inside of their building headquarters. Professional organizations offer recreational trips as part of annual conferences. Federal, state, and local park authorities offer symphonies, plays, and concerts outdoors.

This increased consciousness has created a new need to acquire information about various recreational and physical activities that were almost unheard of a decade ago. In addition to the more common sports of baseball, football, and basketball, young people and adults alike want to know how to hangglide, play racquetball, scuba dive, and even skateboard. Shorter work periods and longer recreational periods have renewed interest in model building, stamp and coin collecting, and even beer can collecting. The interest and enthusiams that this phenomena has ignited has also led to increased publication of books, pamphlets, and articles in journals, popular magazines, and newspapers. How to help students to read and learn about these areas is what this book is all about.

Page Bristow and Alan Farstrup have developed this text for Health, Physical Education, and Recreation teachers employing the philosophy that teachers cannot assume all their students are capable of reading all the textbooks. Just as a physician gives a physical examination in her or his office to diagnose the state of health, so must teachers assess the strengths and needs of their students to determine if they will understand the printed materials used in the course.

The text provides informal, easy to make assessment procedures, with many examples of these techniques; a discussion of the special vocabulary in these areas and how to teach it effectively; and methods of increasing study and comprehension skills. The book concludes with sources of materials for further study and suggestions for evaluating them.

Alfred J. Ciani
Series Editor

1. A RATIONALE FOR READING

It is Monday morning and a student, let's say Phoebe, needs to find some answers to the rules of tennis. A match is scheduled for three that afternoon; Phoebe has been assigned to umpire. There are many ways in which Phoebe could proceed, but the most efficient is to get a copy of the official rules of tennis, read and study it carefully. It is at this crucial point that teachers and students have the opportunity to see positive results achieved through application of the reading techniques put forth in this book that are specifically designed to enable students in the areas of health, physical education, and recreation to read more effectively, learn more efficiently, and, ultimately, to show better performance; in this case, as umpire on the tennis court.

Teachers who know how to evaluate student reading needs and assess the difficulty of classroom materials, who can help students build better vocabularly and improve reading skills, will be those teachers who will well prepare their students for the many challenges where reading skill is an important factor. Well prepared students, obviously, will be able to apply the most effective means to study, for example, the rules of tennis. They will be able to read, study, and review the effects of vitamins on the human body or assess materials in the classroom to determine how best to organize a recreation program. The suggestions and examples offered in this monograph are meant to help teachers work with students, improving their performance in all areas by preparing them to read, comprehend, and study more effectively.

Goals of the Monograph

The major goal of the monograph is to provide reading insights and instructional ideas to teachers in the areas of health, physical education, and recreation. In the example set forth above, the student confronted with the problem of how to quickly review the rules of tennis will have a distinct advantage if he or she has been prepared by means of the reading techniques set forth in subsequent chapters of this monograph.

Secondary, but related goals include those of providing practical, uncomplicated suggestions for identifying the broad categories of reading difficulty expe-

rienced by students, organizing for instruction, coping with technical or other special vocabularies, improving the understanding of written materials, developing important study skills, and selecting materials to meet student needs. In short, teachers will be provided with a wide range of information designed to help them develop student reading abilities in a way that improves and sharpens students in school generally.

The Role of the Teacher

Teachers can help students by anticipating the kinds of general reading problems that might be encountered and by organizing lessons in a way that minimize problems and improve the chances for successful performance.

It is hoped the ideas, approaches, and techniques presented here will help teachers to improve the overall performance of their students in the areas of health, physical education, and recreation, while alleviating some of the frustrations that come with unanticipated reading problems. Perhaps the budding tennis referee will find success instead of frustration as a result of the reading-related help drawn from the pages that follow.

2. ASSESSMENT TECHNIQUES

Many content teachers assume that almost all students are reading on grade level and are ready to learn from the written materials available. Unfortunately, this is rarely the case. Student ability within a class can vary a great deal. Burmeister (1974) indicated that in a fifth grade class reading levels can be expected to range from high first grade to mid-eighth grade level. As students move to higher grade levels the range increases. An average eleventh grade class can be expected to include students reading from the fifth to the fifteenth grade level (Burmeister).

Given this great range of reading facility, student ability to work effectively with written materials and to use skills necessary in the subject area will also vary widely. Therefore, it becomes necessary for teachers to use diagnostic instruments to determine student strengths and needs in important areas. This diagnostic information then enables teachers to include skills review or instruction in their program as needed. If this diagnosis and subsequent instruction does not occur, student learning will be hindered, sometimes severely so.

A number of diagnostic techniques are available to assess student ability. Among the most effective are those prepared by the classroom teacher from materials closely related to those used for instruction. Development of informal diagnostic tools by the teacher has several advantages over using commercially prepared tests. These advantages include:

1. Areas to be tested are those important for success in the particular class.
2. The test can be designed to measure specific concepts or skills.
3. Materials to be used for class instruction can be tested to determine their appropriateness.
4. Results are available immediately and can be used to plan instruction.
5. Questions are similar to those asked in class on a regular basis.
6. Follow-up tests can be given to measure student progress. Demonstration of improvement is motivating for students and teachers.

None of the assessment techniques that will be described here is difficult or time-consuming to prepare, administer, or analyze. All give the classroom teacher information useful in planning and organizing instruction.

Informal Teacher-Made Inventories

Informal tests vary widely in the amount and type of diagnostic information they collect. They can be designed to measure only one specific skill (such as following directions) or a number of skills. They can be administered to a whole class, a small group, or a single student. Whatever the purpose and scope of the informal test, the procedure in constructing the test is the same:

1. Decide what skills will be measured.

2. Design questions that will assess student knowledge of these skills.

Below are several types of informal teacher-made tests designed to assess student ability or interest in a number of areas. In each case, the skills to be tested are noted.

The Cloze Procedure. Fairweather, et al. (1978) described an application of the cloze procedure that can be used to determine the most appropriate match of students to reading materials. The cloze procedure (Taylor, 1953; Bormuth, 1963; Bormuth, 1967) enables teachers to sort students efficiently into three categories: (1) those who can read their textbook independently, (2) those who can understand much of their textbook but need direct teacher assistance or a study guide to grasp it fully, and (3) those who cannot read their textbook well enough to use it effectively.

The procedure follows the "principle of closure," the tendency of people to complete fragmentary perceptions or thoughts, by asking students to fill in blanks formed by deleting every fifth word in a passage. The following is a portion of a cloze procedure based on a seventh grade health text (Richmond et al., 1977):

Nutrients are substances in _____ that perform needed tasks _____ the body. There are _____ main classes of nutrients. _____ are proteins, vitamins, minerals, _____, fats, and water. No _____ food provides all the _____ your body needs. But _____ food such as meat _____ cereal may provide several _____.

To substitute the correct words for the blanks, students must use information related to their knowledge of English rules of grammar and meaning. Since proficient reading requires these same types of information (Goodman, 1967; Ryan and Semmel, 1969), the ability of students to complete such sentences accurately reflects their ability to read and understand them.

Cloze tests are constructed, scored, and the results analyzed in terms of a student's ability to identify exactly the words that have been deleted from the text. Even though most students will be able to insert words that fit the context of the passage, it is important for techers to realize that the interpretation of cloze test results is based upon the proportion of *exact* responses by the student. Obviously, in the "real" world a contextually correct answer is perfectly acceptable, and can be seen as evidence of good reading ability. However, the cloze test procedure described here is designed to provide an index of how well a particular text matches the reading ability of a student. In order for scoring to be clear and unambiguous, only exact replacements for deleted words are scored as correct.

Here are the steps outlined by Fairweather, et al. (1978) that are necessary for the preparation, administration, scoring, and interpretation of a cloze procedure:

1. Select a 30-sentence passage from each eighth of the text, taking into account topical organization as much as possible.

2. Count the number of words containing three or more syllables in each of the eight passages identified in step 1.

3. Find the average of the eight sets of numbers determined in step 2, and select the one passage of the eight examined that is closest to this average. This passage is likely to be representative of the readability level of the text.

4. Mark the sentence that contains the two-hundred-and-fiftieth word in the passage identified in step 3.

5. Type the passage (double spaced), deleting every fifth word. The first deleted word in the passage can be any one of the first five words in the passage. Make each blank one-and-one-half inch in length. Continue until the sentence identified in step 4 has been typed. Fifty words should be deleted.

6. Explain to the students that they are to fill in each blank with the word that fits best. Emphasize that they need not concern themselves with time limits or exact spelling.

7. Give the students as much time as they need to complete the task. Students should be encouraged to reread the passages and make changes or corrections they feel are appropriate.

8. Count the number of correct (exact) responses and divide by 50 to obtain the percent correct. Note that students must write the exact word deleted in order to be credited with a "correct" response.

9. Interpret the percentage scores according to the following chart:

SCORE	INTERPRETATION
58-100%	INDEPENDENT LEVEL The student can read the text independently.
44-57%	INSTRUCTIONAL LEVEL The student can read the text with either direct teacher assistance or with a detailed study guide.
0-43%	FRUSTRATION LEVEL The student finds the text too difficult to learn from it. Other activities and materials must be used instead.

Teachers find the ease of preparation, administation, and scoring of the procedures attractive. Moreover, it allows teachers to measure reading comprehension directly as it occurs rather than indirectly through recall as in "text-followed-by-question" comprehension tests. The procedure also measures student sensitivity to the writer's style, an important determinant of comprehension often untapped by conventional testing procedures.

The cloze procedure provides the teacher with a valid means of identifying student ability to comprehend classroom materials and with information about how to approach instructional tasks. The teacher can choose instructional techniques freely for those students who read the text independently; while for those at the instructional or frustrational level, the teacher must carefully plan instructional techniques to provide sufficient support to enable students to use the written material effectively. Instructional techniques for increasing student comprehension are discussed in chapter 4.

Informal Group Reading Inventory. Another technique available for use in measuring student reading comprehension of text or other classroom material is called the informal group reading inventory. This technique also tests student knowledge of vocabulary words. Procedures for preparing an informal group reading inventory are:

1. Choose a three to five-page selection from the text or other written material to be used in the classroom. Check to be sure that it is representative of other materials that will be used.

2. Read through the material carefully. Note important vocabulary words—those that represent the key concepts in the material. Note also the main idea, important details, and other important aspects students would be expected to remember after reading the selection.

3. Based on notes from the reading, prepare 10 to 15 questions about the passage. Types of questions that may be included and samples are listed below (question types in parentheses). The questions are based on a hypothetical passage that describes the effects and treatment of poison ivy irritation. Additional examples of these questions are provided in the sample of Informal Group Reading Inventory below.

    a. *Main idea question(s)* will require students to determine the main purpose of the selection. (What is the main purpose of this selection on poison ivy?)

    b. *Important details questions* will focus on important factual information directly stated in the selection. (What is the most important factor in the treatment of poison ivy?)

    c. *Vocabulary representing key concepts* questions will measure understanding of words which must be understood if comprehension is to occur. (What is another word which means the same as "remedy"?).

    d. *Inference questions* will require students to infer an idea that is not directly stated by the author or make a judgment that grows logically from the facts stated in the reading. (Why do you think the writer recommends changing clothing after exposure to poison ivy?)

e. *Drawing conclusions questions* will require combining factual information presented, or making a number of inferences from information presented, to draw a general conclusion. (Which would be a better treatment for poison ivy dermatitis: baking soda and corn starch or iron salts? Why?)

f. *Sequence questions* will require that students remember the order in which several events either did occur, or should occur, according to the material read. (List three things you would do after being exposed to poison ivy. Tell in what order they should happen and explain why the order is important.)

g. *Cause and effect questions* will require students, given the information presented, to either remember or infer what the effect of a particular event was or will be. (What will happen if the exposed areas are not treated in a short period of time?)

The number and types of questions included in an informal group reading inventory will depend on the nature of the reading selection and the comprehension skills the teacher plans to emphasize during instruction.

Below is an informal group reading inventory that might be used with senior high students. It is based on a public service pamphlet, *Stress and Your Health**. After each question, the type of question is stated (vocabulary, main idea, etc.). This information is provided here for the teacher's benefit and would not normally be included on the student copy.

Sample of Informal Group Reading Inventory (senior high)

1. **What is the main point of this reading selection? (main idea)**

   a. Understanding stress and the ways in which it affects your health
   b. Emotions that cause stress
   c. Hormones that are produced in reaction to stress
   d. Psychosomatic illnesses

2. **Which of the following would be a situation or feeling that would cause stress? (inference)**

   a. Running a three-minute mile
   b. Anger
   c. A surprise birthday party
   d. All of the above

3. **What is a "psychosomatic" illness? (vocabulary)**

   a. An illness that is caused by, or influenced by, the emotions
   b. An imagined illness
   c. When a person is having a psychological problem
   d. A disease that results from taking mind-altering drugs

*Courtesy of the Metropolitan Life Insurance Company, New York, 1980.

4. **Choose the example below of a pleasant type of stress. (important detail)**

   a. Worrying about office problems at home
   b. Golfing
   c. Watching a football game
   d. b and c above

5. **Put a check by the physical characteristics listed below which are signs that the body is reacting to stress. (inference)**

   _____ a. Rapid heartbeat
   _____ b. Yawning
   _____ c. Deep sleep
   _____ d. Quick movement
   _____ e. Contracting blood vessels
   _____ f. Fast breathing

6. **You have just read about how the body can be affected by stress. Think about a situation in which you have been under stress. Tell what physical reactions you had at that time that may have been related to stress. (drawing conclusions)**

7. **When does stress become a problem? (important detail)**

   a. Anytime it happens
   b. When it is very intense and strong
   c. When it continues to build without a release of tension
   d. When it causes a physical reaction

8. **Given what you have learned about stress, which of the following can be concluded? (drawing conclusions)**

   a. It would be best to avoid stress whenever possible
   b. Being able to relieve excessive stress is important
   c. Stress is usually good for us
   d. Some people never experience stress

9. **If a person experiences continual emotional stress, what might be the result? (cause and effect)**

   a. No effect from the stress
   b. The stress becomes more intense
   c. The stress disappears
   d. Physical illness

Textbook and Study Skills Inventory. Many students, unfortunately, enter secondary classrooms without the skills needed to efficiently use the textbook. Inability to use the headings, subheadings, glossary, table of contents and/or index, and difficulty interpreting figures, charts, or graphs can certainly handicap a student in learning from the text. Since some students may be adept at some of the skills in several areas, a textbook inventory based on the classroom text can be extremely helpful in pinpointing student strengths and weaknesses in study skills and give information that can be used in planning instruction.

The purpose of the textbook and study skills inventory is to determine whether students are able to find information in a textbook by using the parts of the book and by reading bar and line graphs and tables. This inventory can be used most profitably when the text is first given to students, probably at the beginning of the school year or semester.

In order to prepare a textbook and/or study skills inventory, these steps may be followed:

1. Identify the text or written materials upon which the inventory will be based. Be sure it is representative of the materials that will be used regularly.

2. Survey the materials, noting the aids that are provided to facilitate use of the material, such as: bibliography, table of contents, headings, subheadings, index, glossary, and visual aids. These visual aids might include pictures, charts, diagrams, and/or various types of graphs (circle, bar, line).

3. Choose the aids to be included as areas to be tested in the inventory.

4. Prepare 10 to 20 questions that measure the aids to be tested.

Below is an example of a textbook inventory based on a sixth grade health text (Richmond et al., 1977). When presenting a textbook inventory to students, be sure to explain its purpose and assure them that it will not be graded. Encourage them to do their best.

Textbook and Study Skills Inventory

Answer the questions below to show how well you can find information in this book.

1. In what order do the following parts of the book appear? Number each one to show its order in the book.

   _____ a. Glossary
   _____ b. Table of Contents
   _____ c. Bibliography (list of books)
   _____ d. Index

To answer the questions below, put your answer in the ANSWER box. Then tell how you found the answer in the PROCEDURE box. The first question is answered for you.

		ANSWER	PROCEDURE
2.	What is the title of chapter 2?	Drugs & Health	Looked in Table of Contents on page 5.
3.	What is the meaning of protozoan?		
4.	On what pages would you find information about mental retardation?		
5.	On what page is the topic, "Why Should You Exercise?" discussed?		
6.	On what page would you find information about glucose?		
7.	What is the pronunciation key for conjunctivitis?		
8.	Who wrote this book?		
9.	What is the copyright date of this book?		

To answer the questions below, circle the correct answer.

10. Look at the bar graph on page 237. How many students in the class had been vaccinated against German measles?

    a. 24 b. 10 c. 5 d. 0

11. Look at the chart on page 70. What percentage of alcohol in the blood produces clumsiness and serious loss of judgment and coordination?

    a. 0.03% b. 0.9% c. 0.12% d. 0.15%

12. Look at the line graph on page 215. In what grade-level range do the most accidents happen to boys and girls?

    a. 1-3 b. 4-6 c. 7-9 d. 10-12

Organizing for Instruction

As stated earlier, the purpose of diagnostic testing is to determine specific student strengths and needs so that appropriate instruction can be planned.

Instruction based on these diagnosed needs is much more efficient than the frequently used approach of teaching everything to all students. This practice of unfocused teaching almost always wastes some students' time since they have already mastered the skills being taught. Only through diagnostic testing and teaching based on this diagnosis are teachers able to efficiently use class time and ensure that students have the necessary skills to handle the written materials.

Once students have been tested with a diagnostic assessment instrument, the results need to be summarized so they can be used for planning instruction.

An efficient way to summarize the information gathered is by recording the results on a class chart, or profile. The profile should be set to categorize results into types of skills tested. Once results have been summarized in this way, it is easy for teachers to scan the profile chart and determine which students have weaknesses in any of the skill areas. If the teacher plans to group students for skill instruction, it is immediately clear which students to include in each group.

The example of a profile chart displayed below was designed to summarize results of an informal group reading inventory measuring comprehension skills. This basic format can be adapted to fit different sized groups or types of skills measured simply by extending the length of the chart (if more students are included) or by changing the skill categories listed across the top. This type of profile may also be used to summarize results from textbook or study skills inventories or attitude/interest inventories by appropriately modifying the categories.

Comprehension Skills Profile

	Skill Area						
Student Name	*Main Idea*	*Important Details*	*Key Vocabulary*	*Understanding Inference*	*Sequence*	*Cause and Effect*	*Other*

Assessing Attitudes and Interest

Recreation and physical education teachers have a unique opportunity to affect the lifetime recreational habits of their students. Student interest in and attitude toward class activities certainly influence their involvement in later years. For example, a student who develops interest and skill in playing tennis as part of a recreation or physical education program may continue playing for a lifetime. On the other hand, students who dislike physical education may avoid similar physical activity for the rest of their lives. Because young people's enthusiasm for course activities may affect lifetime habits, teachers have a responsiblity to be aware of student feelings and make every attempt to increase student interest and improve student attitudes.

Student attitude and interest are no less important in the health class. Here, also, lifetime habits are being developed. If interest in topics such as nutritional value of foods, first aid, preventive dental and health care are developed in classes, a continued interest in these areas may result.

If teachers adopt the goal of increasing student interest and improving attitudes then they must gather information about their students' attitudes and present level of interest. Several techniques are useful in making this assessment.

One assessment technique often used is observation. Teachers can learn much about students' attitudes and interests by observing how they react to class activities. It is easy to tell which students enjoy basketball by noting the amount of enthusiasm displayed on the days games are played. However, exclusive use of observation to measure interest makes it difficult to get a measure of the relative interest in areas being taught. A student may show interest in all team sports, for example, but prefer to concentrate in one area such as soccer. Often this is not clear to an observer. Another problem with observation as an assessment technique is that teachers often have contact with a large number of students, making it difficult to remember information about individual students.

Student interviews are another way to measure attitudes and interest; however, again, the large number of students teachers encounter makes this technique impractical.

Using a questionnaire is probably the most efficient technique available. As Alexander and Filler (1976) point out, the questionnaire is both easier and quicker than the other techniques listed above.

The procedure for preparing a questionnaire to measure attitudes and/or interest is similar to that followed in preparing informal inventories:

1. Determine what areas of interest and/or attitudes will be measured.

2. Prepare questions that will measure these areas.

Below are examples of attitude and interest inventories that have been prepared for use with students in health, physical education, and/or recreation.

Student responses can be summarized on a profile sheet as suggested in the previous section, "Organizing for Instruction."

Interest Inventory—Food and Health

The areas listed below are topics we may study in our next unit, "Food and Health." Please rank your interest in these topics by circling either the number 2, 1, or 0 next to each topic; 2 = very interested; 1 = somewhat interested; 0 = not interested.

	Very Interested	Somewhat Interested	Not Interested
Basic food groups	2	1	0
Basic nutrients and their functions	2	1	0
Cultural aspects of food	2	1	0
Dieting, weight control	2	1	0
Digestion and absorption of food	2	1	0
Diseases caused by poor nutrition	2	1	0
Food additives, preservatives	2	1	0
Food labeling	2	1	0
Food misinformation, fads, and trends	2	1	0
Junk foods	2	1	0
Menu planning	2	1	0
Nutritious snacks	2	1	0
Relation of food to physical development	2	1	0
Safe preparation of food	2	1	0
Vitamins and minerals	2	1	0

Attitude/Interest Inventory—Physical Education

Number the following sports according to your interest in participating in them. 1 = most interest; 15 = least interest. Five spaces have been left blank; write in sports you are interested in that are not listed. Be sure to include the sports you have written in when you number the sports according to your interest.

_____ a. Baseball
_____ b. Basketball
_____ c. Bowling
_____ d. Football
_____ e. Golf
_____ f. Gymnastics
_____ g. Soccer
_____ h. Softball
_____ i. Tennis
_____ j. Volleyball
_____ k. _____
_____ l. _____
_____ m. _____
_____ n. _____
_____ o. _____

Below are listed some recreational activities. Check each activity that you participated in at least once last year. If you do an activity at least once a month, check it twice (✓✓). If you participate at least once a week, make three checks by the activity (✓✓✓). If the activity is done at only certain times of the year, consider only the weeks you *could* participate.

_____ a. Backpacking
_____ b. Bicycling
_____ c. Canoeing
_____ d. Dancing
_____ e. Hiking
_____ f. Horseback riding
_____ g. Jogging
_____ h. Pool
_____ i. Racquetball
_____ j. Sailing
_____ k. Ice skating
_____ l. Cross-country skiing
_____ m. Downhill skiing
_____ n. Judo
_____ o. Surfing
_____ p. Swimming
_____ q. Walking
_____ r. Water skiing
_____ s. Weight training

Attitude/Interest Inventory—Physical Education, continued

Fill in the blanks by choosing one of the answers listed below the question (questions 1-8) or by filling in the blank (questions 9-12). Choose the answer that best describes yourself or what you think.

1. I am in _____ physical condition.

   a. excellent b. good c. average d. below average e. poor

2. I exercise _____.

   a. everyday b. 3 times a week c. once a week d. hardly ever

3. Winning is _____ important to me.

   a. very b. somewhat c. not

4. I like _____ sports.

   a. team b. individual

5. I _____ to compete against others.

   a. like b. don't like

6. When I play on a team, I am usually _____ as a player.

   a. better than average b. average c. poorer than average

7. I would like to _____.

   a. skip physical education
   b. have physical education twice a day
   c. have physical education once a day
   d. have physical education once a week

8. I play sports to _____.

   a. get exercise b. be with other people c. win d. have fun e. be challenged

9. What I like most about physical education is _____.

10. What I like least about physical education is _____.

11. If I could change something about my physical education class, I would

    _____

    _____

12. My favorite kind of exercise is _____.

3. COPING WITH TECHNICAL VOCABULARY

One of the most common stumbling blocks for students when attempting to learn from written materials in health, physical education, and recreation is technical vocabulary. Students are confronted with a huge number of terms, many of which they have never seen or heard before. Sometimes, the words are familiar, but the meanings are different from their experience or they only have a vague idea of the word's actual meaning. For example, consider the sentence that follows:

> A chemical substance spilled on the skin may be particularly treacherous; causing burns, allergic reactions, and inflammation.

A number of the words in this sentence may be unfamiliar to students. The use of the word "burn" may prove confusing to some who think of burn as resulting only from a flame. Students may have difficulty with the use of "treacherous" in this sentence, having previously encountered the word only in phrases such as "the treacherous water" or "the treacherous rocks." Technical words like "allergic" and "inflammation" also will be unfamiliar to many students. Heavy vocabulary loads make learning difficult even for students who are above-average readers; they, too, have difficulty comprehending material containing so many unknown words.

There are a number of ways teachers can help their students learn technical vocabulary. The sections that follow demonstrate a variety of activities for improving students' technical vocabulary and explain how they might be used.

Identifying and Preteaching Difficult Words

Teachers can greatly reduce the problems caused by technical vocabulary by previewing reading assignments to identify words that may present problems. During this preview, teachers should select those words that express the important concepts in the material. Then, teachers can introduce these words to students before they begin to read. Below are some guidelines (adapted from Thomas and Robinson, 1977) for preteaching difficult words:

1. *Introduce the word in context.* If the sentence from the text offers useful context clues, use that context. If not, prepare a sentence that uses the word in a context that helps to explain the meaning of the word as used in the reading assignment.

2. *Divide long words into syllables.* Words that are carefully pronounced are more easily remembered than words that are not pronounced. "Cardiovascular" becomes much less formidable when divided into smaller, pronounceable parts—car-di-o-vas-cu-lar.

3. *Point out roots, prefixes, and suffixes* that give a clue to the meaning of the word. Words such as "germicide," "antitoxin," "epidermis," and "microbe" are easier to understand when students know these root and affix meanings: cide=kill; anti=against; tox=poison; derm=skin; epi=on; micro=small, and scope=watch.

4. *Give examples of words students already know* that have the same root or affixes. For "germicide," other words that might be introduced are: "herbicide," "insecticide," and "fungicide." For "epidermis," students can be reminded of "Dermassage," a skin cream, or "Dermicel," an acne medicine.

5. *Preteach terms with multilple meanings.* Often, common words, such as ball, strike, and run, have special meanings when applied to another area, such as baseball. Students must learn the technical meaning used in the sport. Knowledge of the more common meanings are not useful and may prove to be misleading.

6. *Relate words to student experience.* Whenever possible, introduce the word in a context familiar to students. For instance, when thermometer is introduced, bring one to class and take someone's temperature. An indoor-outdoor thermometer might also be displayed, and the similarities and differences discussed. This would be an ideal situation in which to mention the thermostat and barometer, pointing out their similar roots and affixes, as well as their similar uses.

7. *Provide sufficient practice.* Students must encounter words to be learned in a variety of contexts. Varied repetition of the words is necessary for learning. Teachers must use the words in speaking and encourage students to do the same. Teachers can create a variety of exercises that will provide interesting ways for students to practice new words.

8. *Teach students skills* that will enable them to be independent in learning new word meanings. Unfortunately, too many students think there are only two skills that can be utilized when an unknown word is encountered—looking in the dictionary and asking someone. While these are certainly useful skills, they should only be used when other tactics have failed. Use of context clues, division of words into syllables, and knowledge of prefixes and suffixes are all skills that enable students to develop independence in figuring out word meanings.

The sections that follow provide examples of exercises that will give students practice in using technical vocabulary. They also encourage development of those skills that will enable students to develop vocabulary knowledge independently.

Developing Use of Context Clues

Use of context is the most valuable skill students can develop to increase their knowledge of word meaning. Context is the *first* clue that should be used when an unknown word is encountered. Unfortunately, many students have been encouraged to use other less efficient clues such as looking it up in the dictionary, sounding it out, or asking someone.

Students usually need direct instruction in context skills before they realize that they can use the words around the unknown term to determine its meaning. At times, students will have to be shown how sentences around the word or even surrounding paragraphs will help explain the word's meaning.

One technique that can be used to increase student use of context clues is the demonstration of several commonly used types of context clues. Those below are adapted from Thomas and Robinson (1977), in which teachers can find a more complete list.

For each kind of context clue presented here, an example relating to health, physical education, or recreation is given.

Context Clues

1. *Direct explanation*: A *toxin* is a poisonous substance.

2. *Experience:* After a period of *strenuous* exercise, you will become very tired. This is your body's way of telling you to stop and rest.

3. *Explanation through example:* Some drugs can lead to *addiction*. When used too often, these drugs will make the body depend on them. For example, some people's bodies depend on alcohol. If they go too long without the drug, they get very sick.

4. *Synonym: Depressants* or downers, are often prescribed by doctors to promote sleep or relaxation.

5. *Comparison or contrast:* Alan was certain he didn't want to play a contact sport like football or hockey, so he went out for *handball* instead.

6. *Words in a series:* Julie's fever, sneezing, and cough suggested she might be suffering from one of the following: a bad cold, the flu, or possibly *pneumonia*.

7. *Inference:* He had stains all over his fingers and teeth from smoking; he coughed all the time; he got short of breath simply climbing three steps. His body was suffering from the effects of *nicotine*.

Another useful teaching technique that gives students practice with context clues is the cloze procedure. The cloze procedure was introduced in chapter 2 as a diagnostic technique; however, it can also be used for instruction and practice. When used for instruction, the cloze procedure can be modified so that instead of omitting every fifth word, every tenth word or only the words to be studied are omitted. One major drawback in using the cloze frequently noted by teachers is that

students often find it hard to consider themselves successful in cloze exercises. Since they have difficulty filling in all the blanks, they feel they are not successful at doing the exercise. It is important to stress to students at the outset that success standards with the cloze are much lower (44% or better is an acceptable score) than the more common standards of test success where 70% is passing.

A modification of the cloze procedure, the maze technique, can also be used. The maze technique is much less frustrating than the cloze procedure since multiple choice selection is easier than providing a word for a blank space and student scores are generally within the range of common standards of success (70%-plus). The maze technique provides a multiple-choice format in which students choose the word that best fits the context. Lunstrom and Taylor (1978) suggest that when preparing the maze exercise, three alternatives be given for each space:

1. The correct word
2. An incorrect word of the same class of grammar (such as noun, preposition, article)
3. An incorrect word from a different grammatical classification.

The maze passage that follows is based on text material from a seventh-grade health text (Richmond et al., 1977). This is the same passage used to illustrate the cloze procedure in chapter 2.

Maze Exercise

Nutrients are substances in [flowers / nourish / food] that perform needed tasks

[in / out / daily] the body. There are [seven / six / source] main classes of nutrients. [He / Need are / They]

proteins, vitamins, minerals, [chemicals / cooking / carbohydrates] fats, and water.

No [meal / two / one] food provides all [nutrients / cookbooks / wholesome] your body needs. But [an / snack / a]

food such as meat [of / or / each] cereal may provide several [vegetarians / growing / nutrients]

Teaching Frequently Used Roots, Prefixes, and Suffixes

Use of context clues is the first strategy readers should use when they encounter an unknown word. If a second strategy is needed, however, they should examine the word for familiar roots or affixes that might give a clue to meaning. Using these two strategies in combination is often all that is needed to independently determine a word's meaning.

The first step in preparing students to use roots and affixes to identify unknown words is to show them that these word parts have constant meanings of their own. "Aqua" means water in all these words: aquatic, aquamarine, aquarium, and aquaduct. The root "circ" means "ring" or "to go around" in all these words: circulate, circuit, and circulation.

The longest word in the dictionary (Dale and O'Rourke, 1971) is a word that could be used in a health class when lung diseases are discussed. It provides an excellent opportunity to illustrate the value of knowing prefixes, suffixes, and roots. The word is "pneumonoultramicroscopicsilicovolcanoconiosis"; it is the name of a miner's disease of the lungs caused by the constant inhalation of irritant mineral particles, such as superfine silicate and quartz dust (Dale and O'Rourke).

Dale and O'Rourke suggest dividing the word into its component parts and then defining each:

pneumono:	related to the lung (as in pneumonia)
ultra:	beyond, exceedingly, super
micro:	very small
scopic:	related to sight (ultramicroscopic: exceedingly small to the sight)
silico:	related to hard stone or quartz, a mineral
volcano:	related to volcanic dust; very fine particles of rock powder
con:	dust (from greek konis)
iosis:	disease

Below are some samples of exercises designed to teach the meaning of word parts. These can be used by the teacher as models in preparing exercises appropriate for the subject matter and student ability level. They are patterned after a series of root word exercises in Dale and O'Rourke's *Techniques of Teaching Vocabulary* (1971). These exercises are a useful way to introduce important prefixes, suffixes, and roots and, at the same time, demonstrate the interrelationship of the words. The use of context is designed to enrich student understanding of word meanings.

A. Root: dent, denti, dento (tooth)

1. A *dentist* is a trained professional who treats the teeth and surrounding tissue of his patients.

2. A dentist's work or profession is called *dentistry*.

3. A tooth is made of a hard substance called *dentin*.

4. A dentist will recommend a *denture*, an artificial set of teeth, for a patient who has lost his teeth.

5. *Dentifrice* is a cleanser for teeth.

6. A *dental* hygienist may recommend *dental* floss for cleaning your teeth.

B. Prefix: hyper- (excessive, more, above, beyond)

1. The child who cannot sit down and is always in motion, may be labeled *hyperkinetic* by some observers.

2. A person who has *hypertension* must be careful to control high blood pressure.

3. A person who has *hyperglycemia* has an excees of sugar in the blood.

4. A person who has abnormally rapid breathing is said to be *hyperpneic*.

5. A person with *hypersensitive* skin must be extremely careful about exposure to the sun.

C. Suffix:- ectomy (to cut out)
- otomy (to cut)

1. When an appendix is infected or inflammed, a surgeon will perform an *appendectomy*.

2. A surgeon may perform a *gastrectomy* to remove a portion of the stomach that is infected with cancer.

3. The small boy had to have a *tonsillectomy* because his tonsils were infected.

4. The doctor in the emergency room performed a *tracheotomy* on the patient with a blocked windpipe to enable him to breathe.

Frequently Used Roots and Affixes. Teachers may find the list of prefixes, roots, and suffixes that follow a helpful aid in planning exercises to teach word parts. With each word part, its meaning and derived words are given.

Roots and Affixes

Prefix	*Meaning*	*Derived Words*
a-	without	apathetic, atrophy
aero-	occurring in the presence of oxygen	aerobics, aerobatics, aerodrome, aerodynamics, aeronaut, aerosol
ambi, amphi-	both	ambidextrous, amphibious
anti-	against	antibiotic, antitoxin, antivenom
cycl-	ring, circle	cyclist, unicycle, bicycle, tricycle
dys-	ill, bad	dysentery, dyspepsia, dysfunction
epi-	on, at, besides	epidemic, epidermis
ex-	out	exhale
fore-	before, in front	forehand, foreleg, foredeck foremast, foresail, forerunner
homo-	same	homogenized, homograft, homosporous, homogeneous
hyper-	above, super	hyperkinetic, hyperglycemic, hypertension
hypo-	under, less	hypochondria, hypothyroid, hypodermic, hypoglycemic
intra-	within, inside of	intrastate, intravenous, intramural, intramuscular, intradermal
is or iso-	equal, homogeneous	isobar, isotonic, isometric
meta (met)-	after, change in place or form	metacarpal, metabolism, metaprotein, metatarsal, metabolic
micr, micro-	small, short	microorganism, microbes, microscope, micronutrient
re-	again	relaxation, rebuild, reflex, relay, react
tang, tact-	touch	tactile, contact, tangible
vas (vaso)-	blood vessel	vascular, cardiovascular

Root	*Meaning*	*Derived Words*
ambul	walk	ambulator, amble, sonambulist
aqua	water	aquaplane, aquarium, aqua dynamics, aquatics
audio	hear, listen to	auditory, audible, auditorium
cardi	heart	cardiac, cardiovascular, cardiogram
caust, caut	burn	cauterize, caustic, holocaust
cide	kill	fungicide, herbicide, insecticide, germicide
corp, corpor	body	corpulent, corporal, corpse
dent, denti, dento	tooth	dentist, dentifrice, denture, dental
derm	skin	dermatology, epidermis
hale	breath	exhale, inhalation, halitosis
hepat	blood	hepatitis, hepatic
hydr	water	hydroplane, dehydrate
medic (medicus)	to heal	medicine, medical, Medicare, medic
optic	eye	optic nerve, optical, optometrist, optician
ortho	straight, right, correct	orthodontist, orthodox, orthopedist
ped, pod	foot	pedestrian, tripod, podium, podiatrist
psych, psycho	soul	psyche, psychic, psychological, psychoanalysis, psychomotor
scope	watch	telescope, microscope
therm, thermo	heat	thermometer, thermos, thermostat
tox, toxo	poison	intoxicate, toxin, toxemia, antitoxin
vent	expose to the air	hyperventilation, ventilation, ventilator

Suffix	*Meaning*	*Derived Words*
-arium	a place for	aquarium, solarium, insectarium, sanitarium
-ectomy	to cut out	appendectomy, tonsillectomy
-ic (ics)	relating to, affected by	alcoholic, allergic, aerobics, gymnastics
-itis	inflammation of	tonsillitis, bronchitis, laryngitis, dermatitis, bursitis
-meter	measure	pedometer, thermometer, speedometer, odometer
-osis	abnormal or diseased condition	cirrhosis, halitosis
-otomy	to cut	tracheotomy
-vorous	eating, feeding on	herbivorous, carnivorous

Understanding Interrelationships Among Words

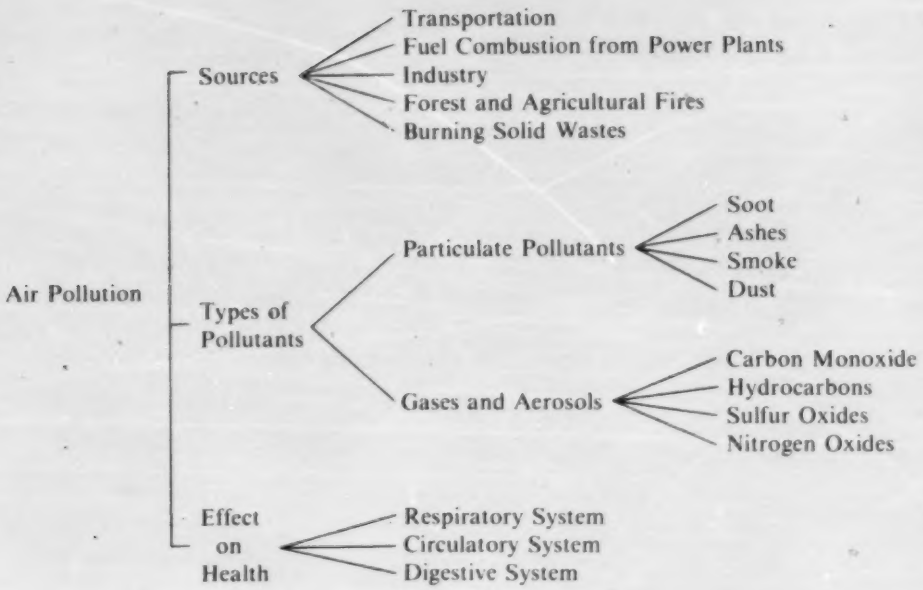
Vocabulary development is a type of concept development. Words are labeling devices for concepts and objects. Dale (1975) points out that "education is a process of developing and refining concepts, applying them to old and new situations." Through using words we can categorize, classify, and reclassify concepts in our minds.

Given the role that vocabulary development plays in learning and concept development, there are many ways teachers can use the interrelationships among words to teach concepts and enable students to explore interrelationships.

The structured overview is a technique that teachers can use to introduce, reinforce, or extend a concept or an interrelationship of concepts. A structured overview is a graphic representation of the relationships among the major concepts in a chapter or a reading passage. The structured overview can also be used to depict the interrelationship of concepts in a lecture, in a film or filmstrip, or on a record.

Below is an example of a structured overview based on a section of a health text that discusses air pollution. Following the example are directions for preparing a structured overview. These directions were adapted from the Indiana Department of Education's *Reading Effectiveness Program / Middle, Junior, and Secondary School Guide* (1975).

Structured Overview—Air Pollution



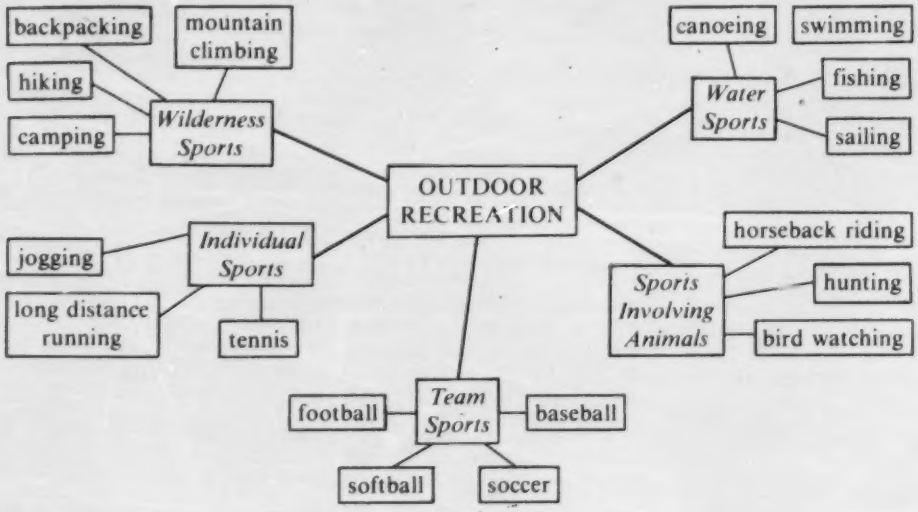
To prepare a structured overview:

1. Preview the material on which the structured overview will be based.
2. List all major concept-carrying words or phrases that are important for understanding the selection.
3. Organize the vocabulary words so that the interrelationships among the words are clearly shown.
4. Add to the diagram words the students already understand that will help to clarify the concepts represented.
5. Examine the overview. Are the major relationships clearly represented? Are the supporting terms properly placed?
6. Introduce the structured overview to students. Explain why the words were arranged in this way.
7. Ask students to add information to the overview. Consider leaving out an important concept and asking students to determine where it should be placed in the overview.
8. As the lesson continues, refer back to the structured overview when appropriate.

After students have encountered a number of structured overviews, they may be encouraged to prepare their own based on information they are studying.

Preparation of their own original structured overviews is an excellent way for students to begin to focus independently on the interrelationship of concepts represented by vocabulary words.

An easier, but similar task is put forth by Dale (1975). He suggests illustrating the interrelationship of words by making "webs of relationships." A similar procedure, semantic mapping, is discussed by Pearson and Johnson (1978). Building a web, or map, of meaning relationships is a fine way of showing how various word meanings are associated with one another. Students can create a web or map of meanings by listing all the words that come to mind in association with a key term such as *outdoor recreation*. By listing the associated words and then displaying them in a web of associated terms, students will have an opportunity to understand more clearly the key term or concept. An example of a webbing or mapping of related words in the field of recreation is provided below.



Dale (1975) stresses that if we can develop systems of interrelated concepts (represented by vocabulary), this system provides a more "efficient mental file," a helpful index to our bank of knowledge. He contrasts this with the all too common practice of asking students to define and learn a long list of unrelated terms where there is no carry-over value from one word to the next. Teaching a web of interrelated words is much more profitable. Then, Dale points out, when one word from a word bank of related terms is practiced, the other terms are generally remembered and used.

Providing Adequate Reinforcement

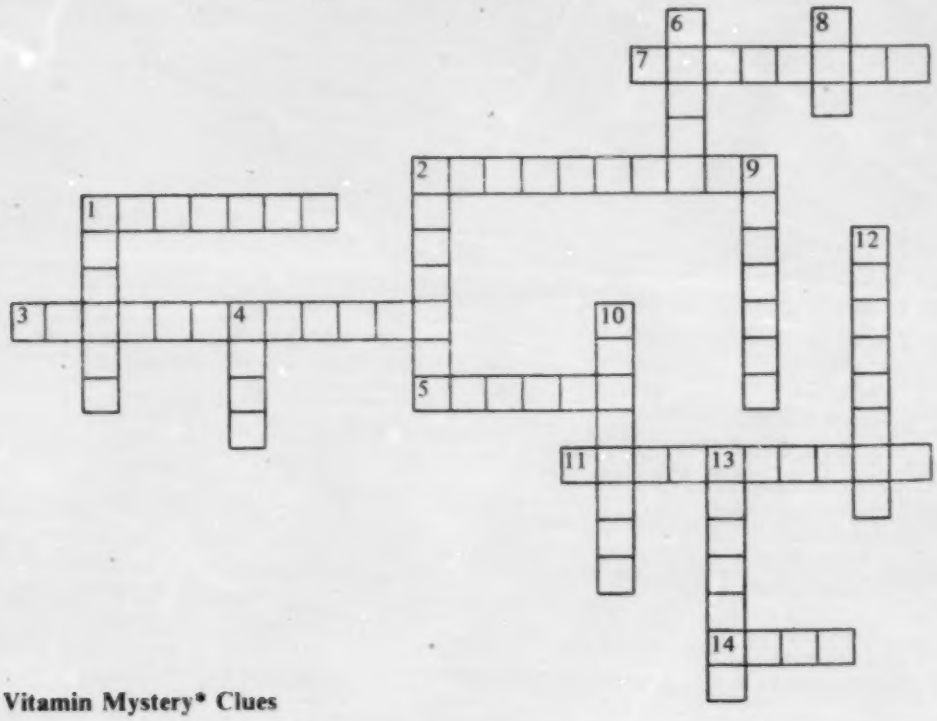
Much of the difficulty that students have in learning technical vocabulary stems from lack of adequate reinforcement. In order to really understand and use a word, students need exposure to the word in a variety of contexts.

A number of activities that can be used to reinforce vocabulary have been introduced previously. Below are some additional examples of activities that might be used to give students opportunities to practice vocabulary words. While the

activities are based on health, physical education, or recreation materials, they are presented here as examples, only. They are provided as models for activities to be prepared by teachers using materials of appropriate content and difficulty for the grade level in which it would be used.

Crossword Puzzle. The crossword puzzle that follows gives students an opportunity to practice their knowledge of word meanings. If the words are relatively new to students, the instructor may want to provide a list, in random order, of all the words used in the puzzle. This makes the task somewhat easier. Words that students have learned previously can also be included. This provides a review of these words and simplifies the task.

Vitamin Mystery



Vitamin Mystery* Clues

Across:

1. Nutrient for building bones and teeth. (CALCIUM)
2. Mineral found in liver, fish, and poultry that aids in building bones and teeth. (PHOSPHORUS)
3. Another name for sugar and starch. (CARBOHYDRATE)
5. This vitamin contributes to a healthy nervous system. (NIACIN)

*This crossword puzzle and its clues were based on the following pamphlet, Martin, M. *The Great Vitamin Mystery*. National Dairy Council, Rosemont, Illinois.

7. Calcium, phosphorus, and iron are all _____. (MINERALS)

11. Another name for Vitamin B_2. (RIBOFLAVIN)

14. It works with protein to produce hemoglobin. (IRON)

Down:

1. Type of fruit supplying Vitamin C. (CITRUS)

2. A nutrient that is essential in building and repairing all tissues. (PROTEIN)

4. Part of the egg that supplies Vitamin K. (YOLK)

6. Food source of many vitamins. (LIVER)

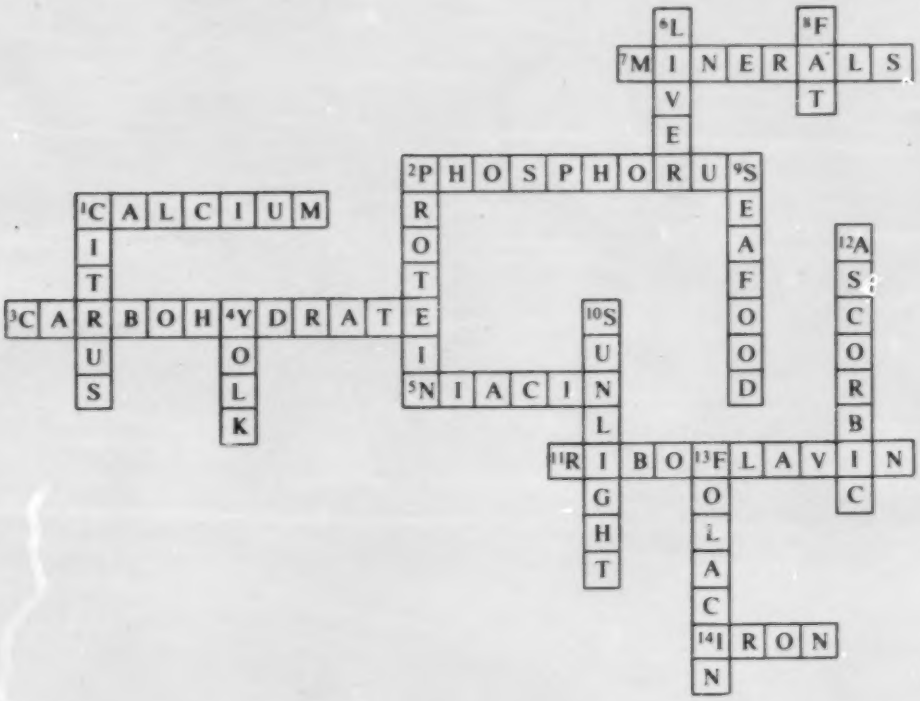
8. This nutrient supplies energy and is found in food sources such as butter, cream, and salad oil. (FAT)

9. Source of iodine. (SEAFOOD)

10. Non-food source of Vitamin D. (SUNLIGHT)

12. Type of acid found in oranges, grapefruits, and lemons. (ASCORBIC)

13. Vitamin found in green leafy vegetables, liver, and yeast. (FOLACIN)

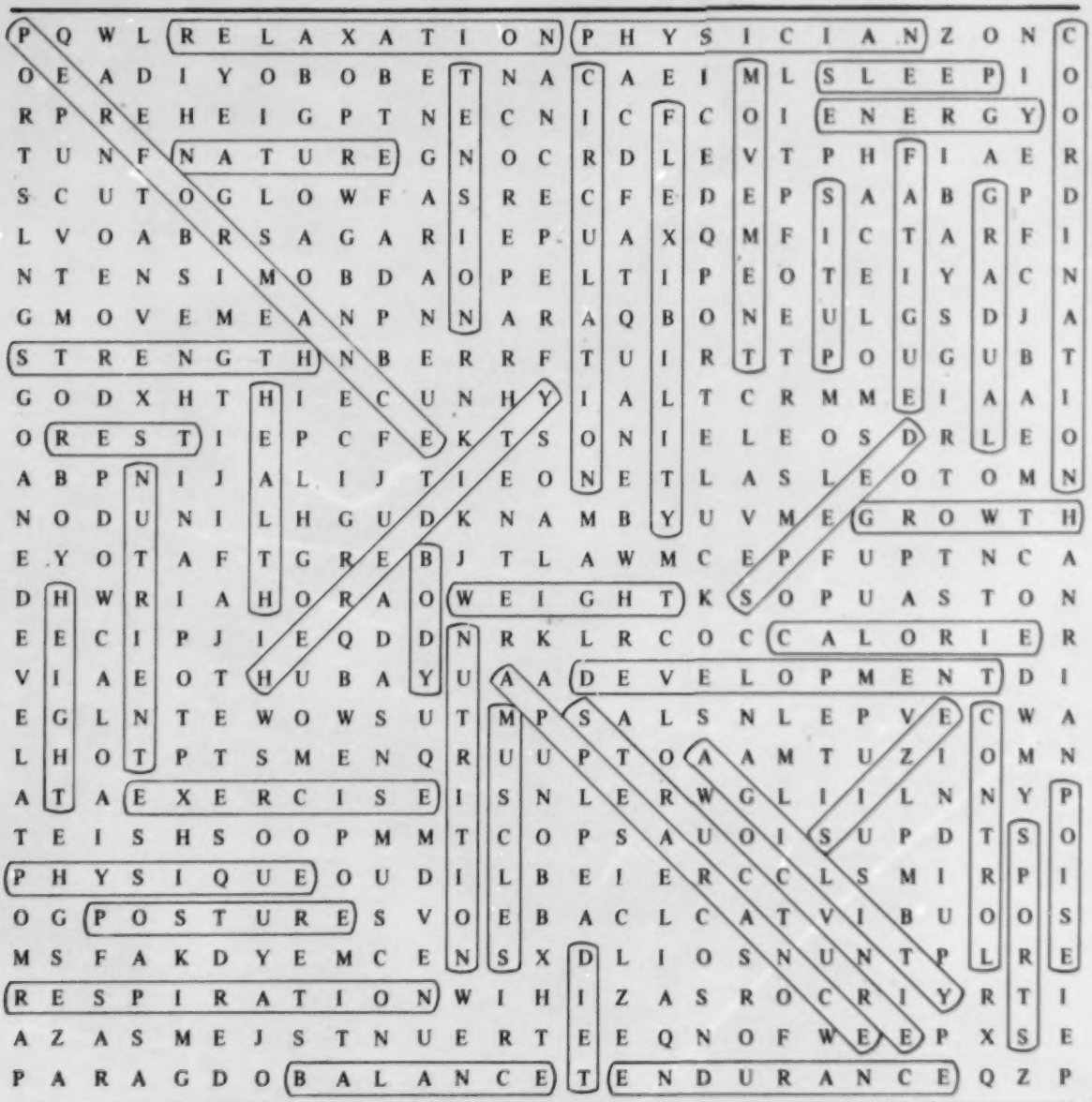


Word Search Puzzle. Word search puzzles are another enjoyable way to practice and reinforce vocabulary. Below is a word search puzzle based on a health pamphlet*. It is followed by the answer key.

P Q W L R E L A X A T I O N P H Y S I C I A N Z O N C
O E A D I Y O B O B E T N A C A E I M L S L E E P I O
R P R E H E I G P T N E C N I C F C O I E N E R G Y O
T U N F N A T U R E G N O C R D L E V T P H F I A E R
S C U T O G L O W F A S R E C F E D E P S A A B G P D
L V O A B R S A G A R I E P U A X Q M F I C T A R F I
N T E N S I M O B D A O P E L T I P E O T E I Y A C N
G M O V E M E A N P N N A R A Q B O N E U L G S D J A
S T R E N G T H N B E R R F T U I R T T P O U G U B T
G O D X H T H I E C U N H Y I A L T C R M M E I A A I
O R E S T I E P C F E K T S O N I E L E O S D R L E O
A B P N I J A L I J T I E O N E T L A S L E O T O M N
N O D U N I L H G U D K N A M B Y U V M E G R O W T H
E Y O T A F T G R E B J T L A W M C E P F U P T N C A
D H W R I A H O R A O W E I G H T K S O P U A S T O N
E E C I P J I E Q D D N R K L R C O C C A L O R I E R
V I A E O T H U B A Y U A A D E V E L O P M E N T D I
E G L N T E W O W S U T M P S A L S N L E P V E C W A
L H O T P T S M E N Q R U U P T O A A M T U Z I O M N
A T A E X E R C I S E I S N L E R W G L I I L N N Y P
T E I S H S O O P M M T C O P S A U O I S U P D T S O
P H Y S I Q U E O U D I L B E I E R C C L S M I R P I
O G P O S T U R E S V O E B A C L C A T V I B U O O S
M S F A K D Y E M C E N S X D L I O S N U N T P L R E
R E S P I R A T I O N W I H I Z A S R O C R I Y R T I
A Z A S M E J S T N U E R T E E Q N O F W E E P X S E
P A R A G D O B A L A N C E T E N D U R A N C E Q Z P

*This word search puzzle is based on the following pamphlet. Gregg, W.H. *A Boy and His Physique*. Rosemont, Ill.: National Dairy Council, 1978.

WORD SEARCH PUZZLE: Answer Key


P Q W L R E L A X A T I O N P H Y S I C I A N Z O N C
O E A D I Y O B O B E T N A C A E I M L S L E E P I O
R P R E H E I G P T N E C N I C F C O I E N E R G Y O
T U N F N A T U R E G N O C R D L E V T P H F I A E R
S C U T O G L O W F A S R E C F E D E P S A A B G P D
L V O A B R S A G A R I E P U A X Q M F I C T A R F I
N T E N S I M O B D A O P E L T I P E O T E I Y A C N
G M O V E M E A N P N N A R A Q B O N E U L G S D J A
S T R E N G T H N B E R R F T U I R T T P O U G U B T
G O D X H T H I E C U N H Y I A L T C R M M E I A A I
O R E S T I E P C F E K T S O N I E L E O S D R L E O
A B P N I J A L I J T I E O N E T L A S L E O T O M N
N O D U N I L H G U D K N A M B Y U V M E G R O W T H
E Y O T A F T G R E B J T L A W M C E P F U P T N C A
D H W R I A H O R A O W E I G H T K S O P U A S T O N
E E C I P J I E Q D D N R K L R C O C C A L O R I E R
V I A E O T H U B A Y U A A D E V E L O P M E N T D I
E G L N T E W O W S U T M P S A L S N L E P V E C W A
L H O T P T S M E N Q R U U P T O A A M T U Z I O M N
A T A E X E R C I S E I S N L E R W G L I I L N N Y P
T E I S H S O O P M M T C O P S A U O I S U P D T S O
P H Y S I Q U E O U D I L B E I E R C C L S M I R P I
O G P O S T U R E S V O E B A C L C A T V I B U O O S
M S F A K D Y E M C E N S X D L I O S N U N T P L R E
R E S P I R A T I O N W I H I Z A S R O C R I Y R T I
A Z A S M E J S T N U E R T E E Q N O F W E E P X S E
P A R A G D O B A L A N C E T E N D U R A N C E Q Z P

Students who have spelling or reading problems may need the aid of a list of words in order to be successful. Below is a list of the words contained in the word puzzle; use of the word list in combination with the word search puzzle is also an excellent way to reinforce correct spelling.

agility
appearance
balance
body
calorie
circulation
control
coordination
development
diet
endurance
energy
exercise
fatigue
flexibility
gradual
growth
health
height
heredity
movement
muscles
nature
nutrient
nutrition
performance
physician
physique
poise
posture
relaxation
respiration
rest
situp
size
sleep
speed
sports
strength
structure
tension
weight

4. IMPROVING COMPREHENSION OF WRITTEN MATERIALS

Students are often confronted by the need to study and retain complex ideas presented in books, articles, or other written materials. The future recreation director needs to read, understand, and—most importantly—be able to apply information about the most effective methods for organizing and carrying out recreational activities. The future health professional will rely on nutritional data provided by food processors and suppliers in printed form to plan a well balanced, healthful food service program for an institution. The future physical education instructor will need to rely on books or other printed materials to provide a wide range of information to students. Teacher attention to simple aspects of the knowledge students bring to any task and to characteristics of the reading materials used in the classroom can greatly improve student understanding and application of what they read.

The Comprehension Process—An Overview

Comprehension is essentially a language process, a process of understanding. Strongly related to student skills and experiences in all areas of endeavor, comprehension is the ability of an individual to acquire information and put that information to use in a practical, productive manner. Reading comprehension, though only one facet of a general intellectual ability, is important. Without it an individual is unable to make use of the wealth of experience and insight others have put into books, articles, and other printed form.

For effective instruction and good comprehension to occur, the teacher must take into account at least these two important factors: (1) the level of reading difficulty of the materials assigned, and (2) the level of student knowledge and experience in relation to the assigned topic. In short, the teacher must make an effort to match, as accurately as possible, the level of the assigned reading materials to the reading skill level of the students, *and* be aware of student background

knowledge and experience in the subject area to be studied.

The student who successfully applies a concept in health education has experienced and demonstrated good comprehension. Comprehension is not a separate process or skill unrelated to a person's knowledge about health issues, recreation, or physical education. It is, rather, an event that occurs or develops in a broad way with relationships to many other aspects of learning and activity. The student who has mastered the backhand return in tennis is much better equipped to understand, to comprehend, a written account of how best to make use of the backhand in a match.

Much of the current thinking and research in the area of reading comprehension can be summarized in the phrase, "Comprehension is the process of relating the new to the known" (Pearson and Johnson, 1978). It is this definition, this notion of what the process of reading comprehension involves, that forms the basis for the practical teaching suggestions that comprise the major portion of this chapter as well as many of the suggestions found in other chapters of this monograph.

In this section, classroom applications are suggested for (1) word association tasks that build on what the student already knows, and (2) for word and concept classification activities that enable the student to see clearly how new concepts or terms relate to old ones. Some examples of different levels of questions that can add depth and variety to classroom discussions are also presented.

Practical Applications to Improve Comprehension

Word Association Tasks to Build Meaning. One important way to build student vocabularies is through word or concept associations. Students who are confronted with new vocabulary or new concepts can be helped to understand them by showing clearly how these new ideas relate to what they already know and understand. A very useful additional effect of the use of word association tasks is the enhancement and enrichment of existing knowledge that occurs as a more complex network of meanings is built up through these associations.

What follows is a series of suggested activities that could be used to improve comprehension through word and concept associations. These suggestions are meant to provide a pattern or framework of ideas that can be further refined and adapted by individual teachers to meet their students' particular needs and concerns.*

The free association task described below is a means by which each student can expand on existing knowledge while being confronted with new concepts and ideas. That is, the student is relating the new to the known in an active and positive way. In addition, the teacher is provided with some very useful information about the level of knowledge and experience the students possess with regard to the topic; in this case, vitamins and nutrition.

1. Have your students list all the words that come to mind when they hear the word, *Vitamins*. (In this example, a unit on the topic of nutrition, you might also present such words as the following: nourishing, digestion, calories, balanced diet, etc.)

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*These activities are adapted from ideas and suggestions contained in *Teaching Reading Comprehension* by P.D. Pearson and D.D. Johnson. New York: Holt, Rinehart and Winston, 1978.

2. Each of your students will generate a list of related words such as:

1. Health	7. Chemicals
2. Fruits	8. Nutrient
3. Medicine	9. Energy
4. Pills	10. Rickets
5. Vegetables	11. Balanced diet
6. Vitamin C	

3. After each student has created her/his own list of words related to the word *Vitamins*, combine all the words generated by the class, using the chalkboard or an overhead projector to collect and display this pooled list of associated words.

4. Next, using the pooled list, have the students suggest groups of words that might go together; giving their reasons for the grouping they want to make.

5. Then discuss each word with the class and explore how it relates to the concept of nutrition in general and to the role of vitamins in the diet in particular.

Classification Activities to Aid Comprehension. Students who are able to see relationships among ideas and group different terms or concepts under headings that express some common or shared meaning are more likely to comprehend complex reading materials such as those often found in the areas of health, physical education, and recreation. Consider the definition given earlier in this chapter, "Comprehension is the process of relating the new to the known" (Pearson and Johnson, 1978). The act of classifying a new term or concept with terms or concepts previously learned can be viewed as an essential step toward learning the new concept. Similarly, the ability to examine a set of words and group them according to similarities in meaning and to provide each group of words with a meaningful label or heading is also evidence of effective comprehension. To the extent that the teacher can encourage these kinds of activities, comprehension will be improved.

Following are examples of three classification activities that may serve as models for designing comprehension lessons in the areas of health, physical education, and recreation:

1. Classification With Headings Provided

Provide the students with a mixed list of words or terms to group under headings supplied by the teacher. Use a format like the following:

Directions: Group each of the following terms under the headings given below.

Words: tetracycline, aspirin, ipecac, anticoagulants, antacids, codeine, penicillin, non-narcotic cough syrup, tranquilizers.

PRESCRIPTION DRUGS	OVER-THE-COUNTER DRUGS
tetracycline	aspirin
anticoagulants	antacids
codeine	non-narcotic cough syrup
penicillin	ipecac
tranquilizers	

Comments: this type of classification activity is relatively easy for students to complete, yet it provides good practice in classification of terms, an aid to effective comprehension.

2. Classification With Grouped Words Provided; No Headings Given

Provide the students with sets of words. Their task is to supply the missing headings. Following is an example:

Directions: Read the two lists of words given below and decide why they are grouped as they are. Write the correct column heading for each group.

Prescription Drugs	over-the-counter Drugs
penicillin	aspirin
tetracycline	non-narcotic cough syrup
codeine	antacids
tranquilizers	bicarbonate of soda

Comments: This activity provides students with the slightly more difficult task of seeing the overall relationships that exist among the listed terms. It, too, is a classification task that enhances comprehension.

3. Classification of Terms Into Several Groups; No Headings Given

Provide students with a mixed list of terms that can be grouped into more than two categories. Provide students with a sheet of paper with blanks for the correct

number of headings (or to make it more difficult, with no indication as to the number of headings needed). For example:

Directions: Examine the list of words given below. Decide how the words might go together and group them under appropriate headings you provide.

Words: bandages, tetracycline, aspirin, antacids, penicillin, non-narcotic cough syrup, ipecac, tourniquets, tranquilizers, splints, codeine, antiseptics, gauze, anticoagulants, bicarbonate of soda.

Prescription Drugs	Over-the-counter Drugs	First Aid Supplies
tetracycline	aspirin	bandages
penicillin	non-narcotic cough syrup	antiseptics
codeine	antacids	splints
tranquilizers	ipecac	gauze
anticoagulant	bicarbonate of soda	tourniquets

Comments: This level of classification is possibly the most difficult of the three types presented. It requires students to determine three separate sets of relationships, to formulate an appropriate heading for each, and to correctly group the words under the correct heading. As a classification activity it, too, improves comprehension.

Questioning Strategies. Asking questions based on material students read is one of the most common techniques used by teachers to guide comprehension development. It is helpful to use a variety of question types in the classroom when discussing such material. Quite often, however, there is a tendency to use a very limited range of question types, which, in turn, limit the kinds of thinking skills students use to answer. The more varied the levels of thinking that students can practice in response to teacher questions, the better their chances are for effective comprehension.

There are three major levels of questions considered in this paper; examples of each are provided below as models for planning instruction.

1. *Literal level questions*, which require students to locate or recall information stated directly in the text.

   Examples: a. What golf club does the manual suggest for a chip shot to the green?

   b. Where does the textbook mention the various uses of protective equipment in football?

   c. How many major food groups does your text discuss, and what are they?

2. *Inferential level questions*, which require students to "read between the lines" in order to draw a conclusion not directly stated in the text. This type of question requires students to use their own knowledge as well as the information in the text.

   Examples: a. Given the differences between a No. 1 wood and a No. 3 wood, which golf club do you think will provide greater distance? Why?

   b. Why do you think protective equipment used in football has changed over the years?

   c. Why do you think experts feel it is important to choose foods from each of the major food groups in creating a balanced diet rather than just taking a vitamin each day?

3. *Critical level questions*, which require students not only to draw conclusions but to use their judgment, to evaluate, and to state opinions based on appropriate factual information.

   Examples: a. Which brand and style of golf clubs would you choose for your own use, and why?

   b. Do you believe that football helmets are the source of many serious injuries and, if so, how and why would you like to see rules or equipment changed?

   c. What would you say to a person in order to convince him or her that it is important to have a balanced diet, and what facts would you use to support your argument?

The three major question types listed above represent a very simple and broad classification of possible question types. There is considerable evidence (Guszak, 1967) to show that teachers tend to use questions that are literal in nature, with the next most frequently used question type being critical. Unfortunately, critical level questions often tend to elicit unsupported opinions rather than carefully thought out judgments or evaluations.

The teacher should attempt to create a balance in the types of questions used in the classroom and to avoid questions that require very little thinking by students. Quite often students are able to respond to questions, especially literal level questions, because the needed information is contained in the question itself. No real thought is required in order to answer a question such as, "Why is the No. 9 iron usually used to loft the ball over nearby obstacles onto the green?" A similar, but much more thought provoking question, might be, "What uses most often are made of the No. 9 iron, which is designed to loft the golf ball high in the air?"

Questioning strategies can be very effectively used in promoting thoughtful discussion of materials read. By starting with literal level questions—to insure that students have a basic understanding of the materials read—and moving progressively to the inferential and the critical levels of questioning, teachers will increase student interest in and comprehension of class content.

5. DEVELOPING NECESSARY STUDY SKILLS

Following Directions

An extremely common complaint made by teachers is that students do not follow directions. This seems especially true in the areas of physical education and recreation; however, the complaint is widespread in health and other content areas as well.

Often the problem is due to lack of motivation or indifference on the part of students. More often than teachers realize, however, students do not follow directions because they are unable to figure out what to do. Sometimes students are confused because the directions are not clearly stated. At other times students are unable to follow directions because readability factors, such as sentence length and terminology, make the directions too difficult.

Since ability to follow directions may be affected by both their difficulty and student motivation, suggestions for improvement in each area are given here.

Increasing Motivation. Student ability and motivation to follow directions can often be increased simply by heightening their awareness of the necessity to do so. This heightened awareness can be accomplished in a humorous but meaningful way. Below is an example of an activity that can be used to increase student attention to the need to follow directions.

Following Directions

DIRECTIONS: Follow the directions below.

If the baseball season begins in July, name your favorite player here _____; otherwise cross out the letter "o" every time it appears in this word: Orioles. If the word "pack" appears in the word "packers" draw a cross here _____ Now go back to the first sentence and circle the word July unless July is the coldest month of the year. Draw a football at the bottom of the page unless the New York Yankees play baseball; if so, draw a

baseball bat. Can you count from five to 10? Do so in reverse, writing the numbers in this space _____. Then, if a wrong answer to the question, "Who won the World Series in 1978?" is the New York Yankees, write "uncle" _____. Draw a line over the third word in this sentence. Write three words ending in Y at the top of this page. Don't write discuss here _____; do write karate here _____. If basketball is a team sport circle all the t's in this word: "athlete." If you're having fun and would like to continue, write "ZOWIE" here _____. If you've had enough, write "forget it!" at the end of this sentence; otherwise write "forget it."

Simplifying Directions. The other major factor that influences student ability to follow directions is the difficulty of the directions themselves. A number of factors affect the difficulty level of directions. Some of these are: spacing and arrangement; sentence structure; difficulty of vocabulary; scope of the activity described; use of illustrations; clarity, and emphasis on key words (Pikulski and Jones, 1977). In order to demonstrate the effects of each of these factors, two examples are given below. The first example (difficult version) is based on a set of directions taken from a book on soccer (Nelson, 1966) and rewritten to illustrate elements and features that should be avoided in written directions. This first version illustrates many commonly made mistakes that can increase the difficulty of directions. Following this first version are explanations of the kinds of errors made.

Following Directions: Difficult Version

In the game of soccer, a player must learn the techniques involved in long distance kicks which include instep kicks, outside of the foot kicks and volley kicks. A long kick should not be confused with a short kick; a long kick usually travels over fifteen yards and a short kick does not. Of course, before a player uses a long kick, he must estimate the distance he wants the soccer ball to go on the playing field. After relaxing the kicking leg, the other foot should be positioned approximately four to six inches away from the side of the ball which is dependent upon that foot as the kicking foot. After positioning the free leg, the kicking knee should be flexed until the player cannot see the ball anymore and then swinging the leg from his hip, the player should straighten the knee and point his toe up. The player should not confuse this with an outside of the foot kick that uses an inward pointed toe or a volley kick that is executed when the ball is in the air. The shoelace portion of his foot should hit the ball almost midpoint. After the kick a player should always remember to continue to swing his kicking leg upward.

Some of the problem areas that make the above directions difficult are:

1. Format and sequence: Format is confusing for the reader. There are no clear steps in the directions for following a sequence. The directions are in one long paragraph.

2. Sentence structure: The sentence structure is unecessarily difficult for the reader. Sentences are rambling, rather than concise.

3a. Vocabulary: *Direction-related*—Unfamiliar words such as "estimate," "demonstrate," "approximately," "positioning," and "executed" are used.

3b. Vocabulary: *Concept-related*—Unfamiliar concepts such as "techniques," "volley," "instep," and "dependent" are used.

4. Underlining key words: Key action words should be underlined to focus the attention of the reader.

5. Illustrations: Illustrations are missing. Soccer skills could be easily demonstrated with simple illustrations (and/or live demonstrations).

6. Purpose of activity: Multiple objectives of the activity are too confusing. Directions should be limited to one objective.

The second example (simplified) is basically the same set of directions; however, they have been rewritten to make them easier to understand and follow. Again the changes are explained and the ways in which they simplify and improve the directions are noted.

Following Directions: Simplified Version

1. Format and sequence

The format of the directions is clear to the reader. The steps that must be followed are numbered and listed in proper sequence.

2. Sentence structure

The sentences are concise and speak effectively to the reader.

There are three basic *long distance* kicks in the game of *soccer*. These three kicks are the instep kick, the outside-of-the-foot, and the volley kick. In soccer, a kick is considered long when the ball travels more than 15 yards.

6. Purpose of activity

Directions are limited to one activity—the *instep kick*. The reader is not confused with additional objectives.

Today you will learn how to perform the *instep kick*. Follow these steps:

1. Decide *where* and *how far* you want the ball to go on the field.
2. Always keep your *eyes* on the soccer ball.
3. *Relax* your body.
4. Keeping your kicking leg relaxed, put your *other foot* alongside of the ball. This foot should be *4 to 6 inches* away from the ball.
5. *Bend* the knee of the kicking foot until you can no longer see the ball. Your knee will cover your view of the soccer ball.
6. Swinging the kicking leg from your *hip*, *straighten* the knee as it comes close to the soccer ball.
7. Your toe should be pointing *down*. The *top* of your kicking foot should hit the ball *slightly below* its middle or *midpoint*.
8. After kicking the ball, continue to swing your leg up. This is called the *follow-through*.

5. Illustrations

The instep kick is demonstrated with a simple illustration. This visual representation of the activity helps the reader understand the written account.

3a. Vocabulary: Direction-related

Unfamiliar word of the first directions are not included. In addition, words such as "decide" and "bend" are substituted for more difficult words such as "determine" and "flex."

3b. Vocabulary: Concept-related

New concepts, such as "midpoint" and "follow-through," are defined for the reader. Unfamiliar vocabulary is not used.

4. Underlining key words

Key words are underlined to focus reader attention on important points to remember.

Consideration of the factors listed here will enable teachers to write directions that are clearer and easier for students to read. When teachers use directions in commercially prepared materials, the factors listed can be used as guidelines for supplemental vocabulary help and aid with illustrations and demonstrations.

Sequence for following directions: A technique that has proven quite helpful in improving student ability to follow directions is the use of a sequence of steps with each set of directions encountered. Teachers should practice the steps with students and ensure that students consciously use these steps until their use becomes automatic. The following steps for correctly following directions were adapted from *Comprehensive High School Reading Methods* (Shepherd, 1978):

1. Read the directions from beginning to end to get a general idea of what to do.
2. Then read the first step.
3. Do what is directed.
4. Reread the step to make sure it was done correctly.
5. Go on to the next step, following procedures 2 through 4 above.
6. Continue to go through the directions step by step until the activity is completed.
7. Finally, reread the entire set of directions to make sure that they were followed completely.

Interpreting Visual Aids

Interpreting visual aids, such as graphs, charts, figures, and diagrams, is another area in which health, physical education, and recreation students experience much difficulty. Teachers often assume students have been taught to use visual aids while, in fact, instruction in this area has been largely incidental. Regardless of the type or amount of instruction that has occurred, teachers rarely find students are adequately prepared to learn from aids of this type. Therefore, since health, physical education, and recreation materials are often presented in visual form, instruction in these skills is a necessity if students are to learn successfully.

A major reason for student difficulty with reading or interpretation of visual aids is that a number of complex thinking/reading skills are required. Students must combine information from various sources to draw conclusions, make judgments, and infer comparisons and contrasts. In order to glean information from the visual aid, they must have a knowledge of the basic concepts involved and a foundation of factual information upon which the concepts are based.

The terminology that represents these concepts and facts is often unfamiliar to students and, therefore, must be taught to students if they are to be successful in interpreting visual aids. Methods for assisting students with technical vocabulary are outlined in chapter 3.

General Guidelines. Below are some general guidelines that can make instruction in the use of visual aids a simpler task. Following the guidelines are a series of sample activities illustrating some methods of teaching the skills required in reading visual aids.

1. *Make clear to students the purpose* of the visual aid. Some common reasons for using aids of this type are:

   a. To summarize information presented in the text.

   b. To provide factual information that supports generalizations made within the text.

   c. To visually demonstrate information so that it can be easily compared.

   d. To present information visually that would be confusing if presented verbally.

   e. To place special emphasis on important concepts presented within the text.

2. *Identify and preteach the concepts* necessary for students to understand the graphic aid.

3. *Relate the visual aid to the content* being studied.

4. *Give students purposes for examining* the table, graph, chart, or figure.

5. *Point out the organization* of the visual aid; how information is presented.

6. *Give students as much guidance and instruction* as necessary to understand the visual aid.

7. *Explain any symbols or abbreviations* used.

8. *Begin instruction with simple visual aids*, initially presenting only a few categories or types of information. Add to the visual aid to increase its complexity only after students have mastered it in simplest form.

9. *Provide students with abundant practice* on visual materials of appropriate difficulty.

Charts. Charts are often used to organize and/or summarize factual information. They are helpful as reference when a specific bit of information is needed, or when one bit of information needs to be compared or contrasted to another.

Students have difficulty with charts for a variety of reasons. Some problem areas that teachers should be aware of are:

1. Students may have difficulty understanding the overall purpose of the chart.

2. They may not understand how column headings are used, and that all information in a column represents one catgegory.

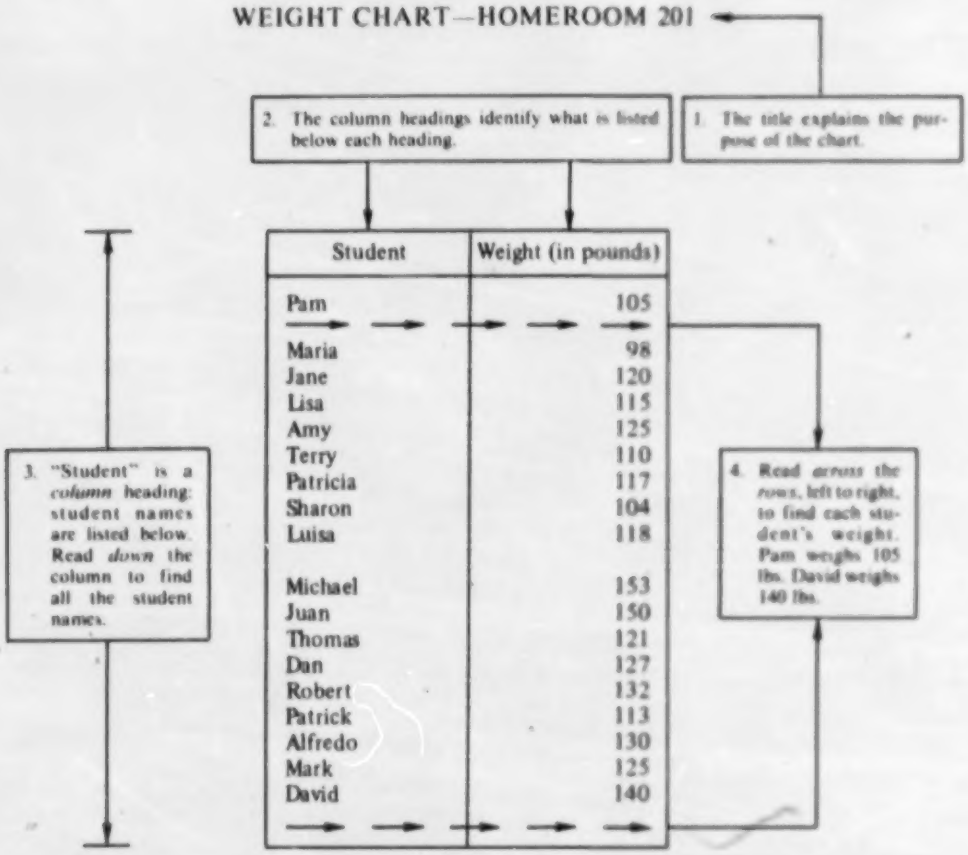
3. They may not understand the process of reading down columns and across rows (from left to right).

4. Students often fail to understand the organization of the chart; the ways in which column headings and subheadings are related.

5. Students may be confused by the amount and variety of information presented.

Direct instruction is usually necessary to help students overcome the problems listed above. Following are sample exercises that demonstrate instruction in the use of a chart. The examples given include notes the teacher can use to focus student attention on those parts of the charts that must be understood in order to successfully interpret the chart. First, a simple two-column chart is presented (see Example 1A) providing only two kinds of information about the students in Homeroom 201: their names and weight. Then, after students know how to read this chart, a third column of information (height) is added (see Example 1B).

Example 1A


WEIGHT CHART—HOMEROOM 201
1. The title explains the purpose of the chart.
2. The column headings identify what is listed below each heading.
Student
Weight (in pounds)
Pam 105
Maria 98
Jane 120
Lisa 115
Amy 125
Terry 110
Patricia 117
Sharon 104
Luisa 118
Michael 153
Juan 150
Thomas 121
Dan 127
Robert 132
Patrick 113
Alfredo 130
Mark 125
David 140
3. "Student" is a column heading; student names are listed below. Read down the column to find all the student names.
4. Read across the rows, left to right, to find each student's weight. Pam weighs 105 lbs. David weighs 140 lbs.

When students understand how two columns are read, show them the chart with three column headings. (See Example 1B).

Example 1B

1. Note change in title to include additional information presented.

HEIGHT AND WEIGHT CHART—HOMEROOM 201

2. Three column headings—height has been added.

Student	Weight (in pounds)	Height (in feet and inches)
Pam	105	5' 0"
Maria	98	4' 11"
Jane	120	5' 4"
Lisa	115	5' 1"
Amy	125	5' 5"
Terry	110	5' 3"
Patricia	117	5' 8"
Sharon	104	5' 0"
Luisa	118	5' 6"
Michael	153	5' 9"
Juan	150	5' 6"
Thomas	121	5' 5"
Dan	127	5' 2"
Robert	132	5' 7"
Patrick	113	5' 4"
Alfredo	130	5' 4"
Mark	125	5' 9"
David	140	6' 0"

3. Read across the rows to find each student's weight and height. Pam's weight is 105 lbs. and her height is 5' 0".

4. Read across the row to find David's weight (140 lbs.) and height (6' 0").

Graphs. Graphs are usually designed to show how information is related, or to facilitate the comparison and/or contrasting of information. While providing all the information a chart offers, graphs go beyond the charts' simple reporting of factual information to present information visually so that groups of information are easily compared or contrasted. Graphs come in a variety of types; some common ones are circle (pie), bar, and line graphs. The type of graph used depends on the nature and complexity of the information to be presented. Common types of graphs, their uses, and aids to instruction in their use are discussed below.

Circle Graph

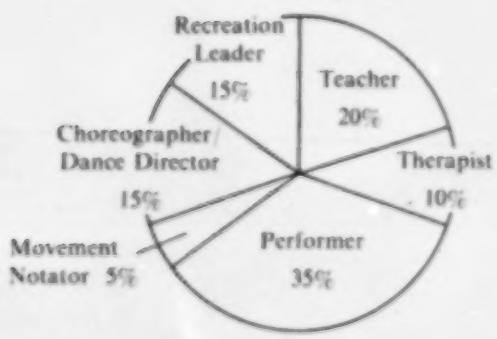
A circle graph is used when the information to be presented can be expressed proportionately; that is, to show the relationship of the parts of something to the whole. The information included is usually stated in percentages. Aspects of only one main topic and one category can be presented in a circle graph. Use of the circle graph helps readers see the relative size of the percentages or parts.

Below is some information presented first in chart form and them as a circle graph. It is assumed here that the students have been taught to read charts (see the preceding "Charts" section) and that no instruction in that area is needed.

Careers in Dance
Student Preferences*

Career	Percentage of Students Indicating Preference
Teacher	20
Therapist	10
Performer	35
Movement Notator	5
Recreation Leader	15
Choreographer/Dance Director	15
Total	100

Careers in Dance
Student Preferences*



*These are preferences of a hypothetical class.

Once students understand the basic principles of a circle graph, have students prepare a graph themselves. Involving students in actually preparing graphs is one of the best ways to give them practice in reading and interpreting them.

On the next page a worksheet is provided as an example of the type that could be used for instruction. Before students begin, they must understand a basic concept: that divisions on a circle graph are formed by converting the percentages to degrees on the circle and marking off that number of degrees.

Steps that could be followed in presenting this concept to students are listed below:

1. Show students that the sum of percentages representing each proportion equals 100%.

2. Tell students that a circle has 360 degrees.

3. Explain that it is necessary to convert the percentages to degrees so that the categories can be represented in degrees on the circle graph.

4. To convert percentages to degrees, students must multiply the percentage for each category by 360.

5. Give the students the following example taken from the worksheet on the following page. Physical Fitness represents 10% (.10) of the total amount of time spent on the activities listed: .10 x 360 = 36 (36°).

6. Then have students measure the angle on the worksheet graph and show them that the angle representing the category is equal to 36°.

7. Do several examples for the students, marking off the sections on the circle graph. Examples have been marked on the worksheet below.

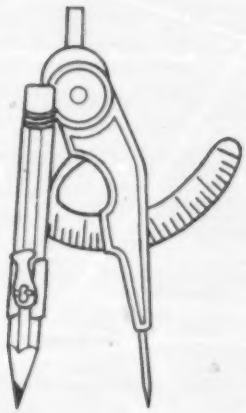
Amount of Time Spent on Various
Instructional Activities in a Physical Education Class*

Instructional Activity	Percent of Time Spent on Activity	Conversion to Degrees
Physical Fitness	10	36
Team Sports	40	144
Individual Sports	35	126
Health/Safety	15	54
Total	100%	360°

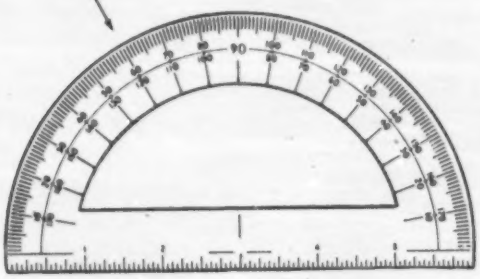
Make sure columns add up to 100% and 360°.

*These are activities of a hypothetical class.

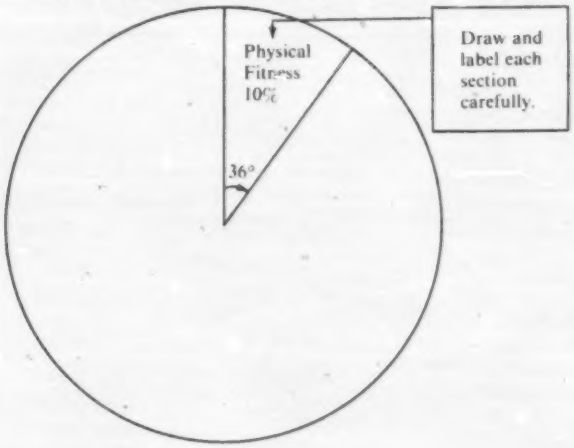
Use a compass to draw the circle and mark the center of the circle.



Use a protractor to accurately measure the angles. This will ensure that the sections are the proper size.



Amount of Time Spent on Various
Instructional Activities in a Physical Education Class

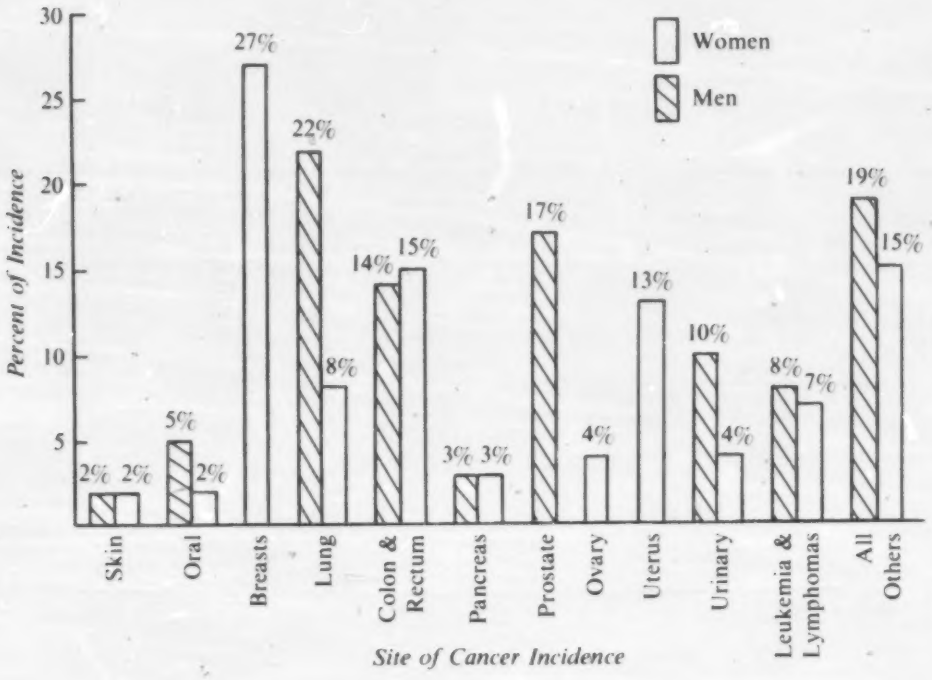


Bar Graphs

Bar graphs can be used to provide more complex information than circle graphs. While a circle graph can only present information on one group or category, a bar graph can provide information on several groups or categories related to one topic. The following example shows how information from two or more categories—site and sex of cancer incidence—can be placed together in one graph. When information is presented in this way, comparisons are greatly facilitated.

When students are first introduced to bar graphs, the graph should be simple, presenting only one category of information. If this were to be done with the example shown, only one category (say estimated cancer by site among women) would be represented. Then, after students understand the concept, the second category (estimated cancer by site among men) can be added as shown.

Cancer Incidence by Site and Sex—1979 Estimates*



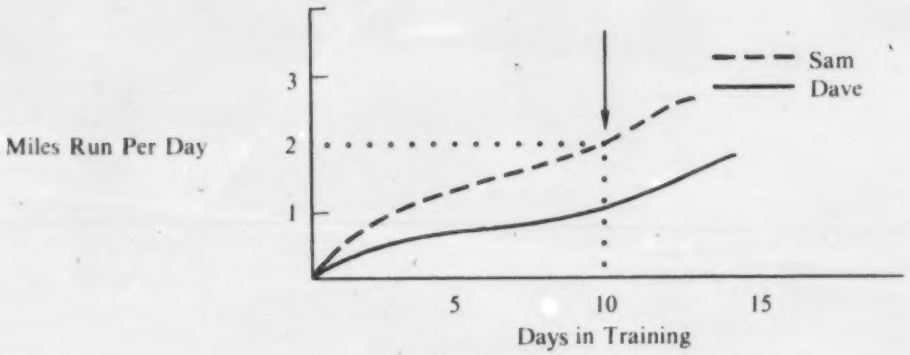
*Adapted from *Cancer Facts & Figures*. New York: American Cancer Society, 1978.

Line Graphs

Line graphs are usually used to illustrate how a variety of groups or categories change over time or react to some sort of treatment. A larger number of categories can be presented when using a line graph than when a bar graph is used. Another function of a line graph is to present how one variable changes as another variable changes (for example, how heartbeat changes as movement changes from standing still, to walking, to running).

An example of a line graph that dispays information over time about three types of cancer follows. However, before asking students to read two or three-category graphs, a simple one-category line graph should be presented. Then, after students have mastered this, additional categories can be introduced and included on the graph.

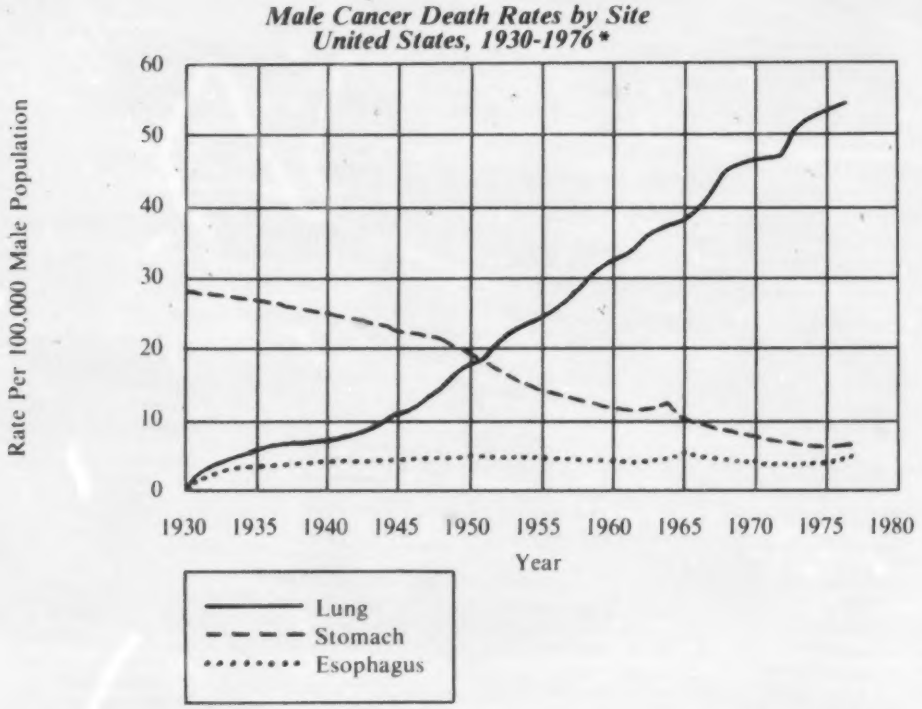
Probably the most difficult concept for students to understand when learning about line graphs is that each point on the graph represents two bits of information about the category represented. For example, in the graph below the point marked with an arrow indicates that when Sam had been in training for 10 days, he was running two miles per day.



Other points students must understand in order to read line graphs are:

1. The title explains the purpose of the graph, and also presents the categories represented by the graph.

2. The numbers along each axis represent amounts of the category labeled (i.e., in the graph "Male Cancer Death Rates by Site, 0, 10, 20, 30 represent rate per 100,000 male population; the numbers along the vertical axis, the year).



*Adapted from *Cancer Facts & Figures*. New York: American Cancer Society, 1978.

3. The key explains what each type of line on the graph represents (i.e., lung cancer is represented by a straight line, stomach by short dashes, esophagus by dots).

4. The graph is read from left to right on the horizontal axis and from bottom to top on the verticle axis.

5. Points that are higher on the vertical axis represent larger amounts of the category represented; and those to the right on the horizontal axis; the most recent data.

Line graphs are more abstract than the other types of graphs presented because the relative proportions of categories are represented by their position on the graph, rather than by some concrete figure. In a circle graph the relative importance of a category is clear because its size is directly represented by the appropriate portion of the circle. A bar graph is more abstract but still concrete in that the length of the bar represents the relative proportion. In a line graph, however, only the distance (both up and out) from the left-hand corner of the graph indicates their position in relation to the categories. This lack of concreteness can make reading a line graph very difficult for students. Thus instruction should be thorough and progress at a rate that enables students to be successful.

Diagrams. Diagrams are drawings that explain something by outlining its parts, workings, etc. Difficulty in interpreting diagrams is often due to these reasons:

1. Drawings are two-dimensional (flat); the object being represented is three-dimensional.

2. Students may have difficulty conceptualizing the dimensions or size of the object represented, especially when it is reduced or enlarged for ease of presentation.

3. Students may be confused by the position from which they view the diagram as represented by the artist. The view may be from the top, side, or even through several layers of the object.

4. Vocabulary used in the diagram may be unfamiliar to the reader.

The easiest solution to a problem in interpreting a diagram is direct experience. If students are having difficulty understanding the dimensions of a tennis court, take them out and show them an actual court. If they are having difficulty understanding a diagram of how the blood runs through the heart, bring in a model of the heart. If students in physical education do not understand how a football play works, have them walk through the play. Then the diagram is used as reinforcement, for review. It also can function as a written reference.

If explaining a diagram through direct experience is not possible, other techniques must be used. When students are having difficulty conceptualizing size, compare the object to something that students know well. For instance, a person's heart is about the size of a closed fist.

When students are confused by the position from which they view an object in a diagram, often clarification of their position can solve the problem. For instance, a diagram of a tennis court is usually drawn as if the person examining it is viewing it from above; while an organ of the body may be shown as a cross-section to enable illustration of its functioning parts. This viewpoint often must be made clear to students if they are to understand the diagram.

When vocabulary used in labeling the diagram is unfamiliar to students, teachers must first teach the terms. A format for teaching unknown words is found in chapter 3.

Applications of Study Techniques

Effective study habits are based upon student ability to be systematic about reading and reviewing content materials. reading must be purposeful and active if good retention and comprehension of information is to occur. These observations hold in all areas of instruction as well as in the areas of health, physical education, and recreation.

A wide variety of study procedures have been developed by numerous authors over the years, the best of which provide the student with a clear framework or a logical sequence that serves to improve the effectiveness and efficiency of a student's study efforts.

Most proposed study sequences suggest that the student follow a definite series of steps. Such sequences usually include, in some form, the following major elements:

1. The student should have a clear purpose in mind—a problem to solve before beginning an assignment.

2. The student should be aware of the major topics and concepts that will be presented in the materials to be read.

3. The student should be aware of the organizational structure of the materials to be read.

4. The student should read aggressively in order to seek answers to specific questions or to solve particular problems.

5. The student reader should seek to systematically record the results of the study process in a brief, concise manner that can be easily revised or reviewed.

6. The student should periodically review and reconsider the materials read and her/his written notes based on it to ensure that the information and concepts are retained and clearly understood.

The PAR-4 Study Technique. McGuire and Bumpus (1971), in developing their PAR-4 study technique, point out that effective study is systematic study. The PAR-4 study technique is designed to provide students with a clear sequence of events that can be followed in studying. The term PAR-4 is an acronym that represents the essential steps of PREVIEW, ASK, READ, RECORD, RETHINK, and REVIEW. The following outline demonstrates the essential elements of the PAR-4 study technique and has been adapted from materials developed by Drs. Marion McGuire and Marguerite Bumpus at the University of Rhode Island. The materials are included in *The Croft In-service Program, Reading Comprehension Skills* materials (McGuire and Bumpus, 1971).

1. The PREVIEW Step:
   Have students preview a chapter by reading the chapter title, introductory paragraph(s), section headings, subtitles, graphs, charts, illustration captions, and summary paragraphs. This process causes students carefully to attend to the major topics of the chapter and to the organizational scheme the writer has used. Seeing the organizational pattern of written material is a very important step toward understanding the content. If the chapter does not contain section headings or subtitles, have the students PREVIEW by reading the title, the first paragraph, the first sentence of every third or fourth paragraph, or the concluding paragraph. Note that the PREVIEW step does not involve a detailed reading of the selection. Detailed reading is not the purpose of this step. The main purpose of this PREVIEW step is for the reader to become familiar with the major topics and organizational patterns of the material to be studied.

2. The ASK Step:
   Have students look at the chapter titles, headings, italicized words, topic sentences, or other key words in the selection. Each key term or heading should be transformed into a question statement. For example, the key word *roughage* might be found in a health chapter. The resulting question formed during the ASK step could be, "What is the meaning of the term *roughage*?" The student should record each question statement on a two-column sheet such as that shown in Example 1 below. Following the ASK step, the student should have a list of questions that parallel the major topics and concepts of the assigned reading. The main objective for the ASK step is to establish clear reasons or focal points around which productive reading of the text can occur.

3. The READ Step:
   Have the students read the selection, actively and aggressively looking for answers to the questions developed during the ASK step. The topic and structure-awareness gained during the PREVIEW step will also be helpful, providing a context for the active READ step. Students should take mental note of the answers as they develop during the READ step and use this information in order to accomplish the next step in the PAR-4 study procedure.

4. The RECORD Step:
   Have the students jot down notes, facts, or answers to questions that are found as the reading progresses. The RECORD step allows the students to take structured notes in response to the ASK step as the reading to seek facts and answers proceeds. The RECORD step also promotes efficiency in learning the materials while it reduces the need for lengthy rereading of a text to seek important details which may be needed at a later time. The RECORD step is, in fact, an organized notetaking process that grows directly out of the PREVIEW, ASK, and READ steps of the PAR-4 procedure. The RECORD step can be carried out in a stenographer's notebook, on ordinary lined notepaper, or on index cards that can serve as a file of information for later review.

5. The RETHINK Step:
   Have the students add questions or comments to their recording sheets that go beyond the level of finding literal information in the reading selection. At this point in the PAR-4 procedure, the students should be directed to ASK and RECORD any additional

questions or problems that have arisen as a result of the first four steps of the study process. For example, students might wish to explore the various kinds of food industries or businesses that exist. Item 5 in Example 1, below, shows one type of additional question and response that might be added to the recording sheet at this stage. Here students will make inferences, draw conclusions, or ask additional critical or evaluative questions which have grown out of their careful, systematic study of the materials. The teacher should encourage students to try to think beyond what the writer has said literally and to pose new questions or seek answers to questions or problems which have been an outcome of the reading and study process. One very important outcome of the RETHINK step, then, is the introduction of higher level, more abstract questions that go beyond literal recall of the facts in a selection.

6. The REVIEW Step:

Have the students undertake frequent and periodic review of the materials on their ASK and RECORD pages. Students should reread their written notes and make additions or corrections (much as in the RETHINK step) on a regular basis. A regular review provides improved long-term retention of information learned through the application of the PAR-4 procedure. An example of a very effective way for the REVIEW step to be undertaken is the self-test. Students can test themselves by using the ASK column as a series of test questions. Have your students cover the RECORD side of the page while responding orally to the items on ASK side. Responding orally to each question or working with a fellow student to recall and discuss the answers will greatly enhance the learning processs.

Example 1—The PAR-4 Study Technique*

Student Name _____ Date _____ Book Title: Health, A Way of Life** Author: Pollock, et al. Chapter Title: Nutrition and You Page(s) _____	
ASK	**RECORD**
1. What is the meaning of the term *nutrition*?	1. Nutrition has to do with the foods we eat and how our body uses them.
2. Why do we eat the foods we do?	2. They taste good to us, habit, because the foods were prepared for us.
3. How are eating habits formed?	3. Family customs, what can be afforded, ethnic background.
4. How does the food business affect my eating habits?	4. Convenience foods, additives, variety of diet, junk foods all related to the food business.
5. (RETHINK) What different kinds of food businesses exist?	5. Supermarkets, food processing and packing companies, fast-food chains, chemical companies that make food additives and advertising.

*Note: This recording sheet format is that suggested by McGuire and Bumpus (op. cit.) The example given here is not meant to be an exhaustive treatment of the topic of nutrition but is designed to illustrate how a student might respond to the ASK and RECORD steps of the PAR-4 procedure.

**Pollock, M.B., Purdy, C.O.; and Carroll, C.O. *Health, A Way of Life*. Glenview, Illinois: Scott, Foresman and Company, 1979.

Teachers who plan to use the PAR-4 study technique should choose a well organized chapter or other reading selection and apply the process to the material themselves in order to have a clear understanding of the task they will require of their students. Following this preparation, the teacher should demonstrate the PAR-4 procedure to students directly so any questions that arise can be dealt with immediately. One major purpose of teaching students the procedure is to encourage a flexible approach to the reading of content materials. Unfortunately, many students habitually read all materials in the same way, as if they were reading a novel or a magazine article about a familiar topic. A procedure like PAR-4 can be used to add flexibility as well as structure to student reading and study habits.

A Structured Notetaking System. Notetaking is an essential element of efficient study. The PAR-4 study technique (McGuire and Bumpus, 1971) describes a recording procedure whereby students write down questions and answers in a two-column ASK and ANSWER format. A similar procedure using RECALL and NOTES column head has been investigated by Palmatier (1971) and proposed by Aaronson (1975) for use in a lecture or listening setting.

The two-column notetaking procedure proposed by Aaronson is based on the

idea that increased involvement of the student in the lecture process combined with immediate and periodic review of written notes, will benefit students by increasing their retention and understanding of lecture or demonstration notes.

The following essential steps for using the two-column notetaking procedure are adapted from procedures developed by Aaronson.*

1. The student should use an ordinary sheet of loose leaf notepaper divided into two vertical columns. The right-hand column should be the larger one, approximately 6" wide.

2. The student should record the main points of the speaker's flow of ideas in the right-hand column of the recording sheet displayed as Example 2 below. The notetaking should be done in the usual fashion of jotting down main ideas, phrases, key terms, or important facts that highlight the main points conveyed by the speaker.

3. As soon after the lecture or demonstration as possible, the student should take the time to review the notes in the right-hand column of the recording sheet. At this time, any missing information or additional information should be added to these notes in order to make them more complete and accurate. This immediate review step has been shown to promote very effective learning reinforcement for students.

4. Next, have the students use the left-hand column of the recording page to jot down key terms, clarifying comments, and questions that need to be answered or which illustrate the main points of the lecture or demonstration. Most of these entries probably will be in the form of questions or summary phrases.

5. A final step in the process is to have the student use the information contained in the left-hand column of the recording page as a self-test and active review. Have the students cover the right side of the page and use the questions on the left as test items for purposes of review. Following this self-test phase, have students jot down any further questions that need to be asked later in class.

Example 2—A Two-Column Notetaking Format Table

NAME _____ DATE _____
NAME OF SPEAKER _____
TOPIC _____

RECALL AND QUESTIONS	LECTURE NOTES

*Aaronson, Shirley. "Notetaking Improvement: A Combined Auditory, Functional, and Psychological Approach." *Journal of Reading* (October 1975), p. 10.

The teacher can encourage students to use this approach to notetaking by providing them with blank notetaking forms set up according to the suggested format and by reviewing with them the essential steps of the process. Students should then be given the opportunity to use the format in a lecture or demonstration setting. Immediately after the lecture, students should be given time for review and filling in the left-hand RECALL column. At this point, the teacher should discuss the notetaking process with the students and suggest additional kinds of questions and comments that might be recorded in the notes. Following this discussion, the teacher should direct the students to review the lecture by using the RECALL column as a self-test in preparation for a discussion or quiz during the next class meeting. In this way the teacher can actively encourage the use of this very systematic notetaking procedure.

6. SELECTING MATERIALS

Since materials are often used as the core of the instructional program, selection of the materials to be used is an important process. A wide selection of materials is currently available, both from commercial publishers and from official and voluntary health agencies. Materials should be chosen following a careful, thoughtful examination of those available. Below are criteria that may be used in selecting materials. These criteria should be adapted to fit particular situations. The relative importance of the criteria used must be determined by individual teachers to suit the instructional needs of their students. For example, the reading level of the material may be the most important selection criterion used in one situation, while the type and quality of the content of the material may be of utmost importance in another situation. Again, teachers must make these decisions for themselves.

Criteria for Selecting Materials

I. How current is the information presented?

- A. What is the copyright date?
- B. Are the concepts and theories up to date?
- C. Are outdated ideas included?
- D. Is the terminology current?
- E. Are illustrations current enough to be effective?

II. Does the content included match the goals of the course?

- A. Do the concepts covered match the goals of the course?
- B. Are important concepts explained clearly and thoroughly?
- C. Does the material emphasize the topics the course stresses?

III. Are useful study aids included?

- A. Glossary?
- B. Pronunciation key (either within text or in glossary)?
- C. Index?
- D. Headings and subheadings?
- E. Preview questions?
- F. Overview and summary for each chapter?
- G. Are important vocabulary words and concepts clearly presented?
- H. Are graphs, charts, illustrations, and diagrams easy to understand?

IV. Is the material suitable for the student population to be taught?

A. Is the reading level appropriate for students?
B. Are the concepts of appropriate difficulty given student background?
C. Are instructional tasks arranged in a logical order?
D. Is there a proper balance between instructional and practice lessons?
E. Is the material organized so that differentiated assignments can be used?

V. Will the material be appealing to students?

A. Are there attractive illustrations?
B. Is the size and amount of type on a page appropriate for the age of the student?
C. Is the cover colorful and attractive?

Determining Difficulty Level of Reading Materials

If students are to learn efficiently from content materials, the reading level of the materials must be appropriate. A number of factors affect the readability of written materials. Some of these factors are:

1. Difficulty of vocabulary
2. Sentence complexity
3. Student interest
4. Student background of experience
5. Number and difficulty of concepts presented
6. Organization and format of material

If the authors of materials are content specialists rather than educators, they often do not attempt to control factors that affect readability; this can result in difficult reading for students.

A number of measures are available to examine some of the key factors that affect readability. The factors generally considered by readability formulas are sentence complexity and difficulty of vocabulary. Sentence complexity is usually measured by the length of the sentence, whereas vocabulary is judged by the number of syllables in the words or by whether words are included in a list of "easy" words.

However, since only some factors are considered, the readability measures must be viewed as approximations of the reading level of the material, not absolutes. The content teacher must still be responsible for judging the difficulty level of concepts, the interest level of materials, and the match between the materials and the background experience of students.

Given these cautions a useful readability formula presented in graph form is presented below. The Fry Graph was selected for presentation because it is easy to compute and is used widely by secondary teachers. Directions for computing and a worksheet are provided to guide teachers through the process of using the Fry Graph.

FRY GRAPH FOR ESTIMATING READABILITY

Directions

Part I

1. Randomly select a representative 100-word prose passage from the beginning of a book or article.

2. Mark the beginning and end of the 100-word selection. (Skip any numbers unless they are written out—skip 79, count seventy-nine.)

3. Count the number of sentences in the 100-word passage. (Use a decimal for a partial sentence—example, 6.4 sentences.)

4. Count the number of syllables in the 100-word passage. (Remember that each word has at least one syllable so you may want to count the additional syllables and add 100).

Part II

1. Choose at least two other representative 100-word passages at random. If only two more are chosen, choose them from the middle and end of the book.

2. Count sentence length and number of syllables just as you did above for each of the additional 100-word selections.

3. Record the results of your work on the worksheet that follows, including the results of the first passage computation in Part I above.

Part III ***Fry Readability Formula Worksheet***

Title: Publisher:

Passage Number	Page Number of Passage	Number of Sentences in 100-Word Passage	Number of Syllables in 100-Word Passage
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Number of Passages Total _____		Number of Sentences Total _____	Number of Syllables Total _____

Part IV

1. Divide the total number of sentences by the number of passages. This will give the average number of sentences.

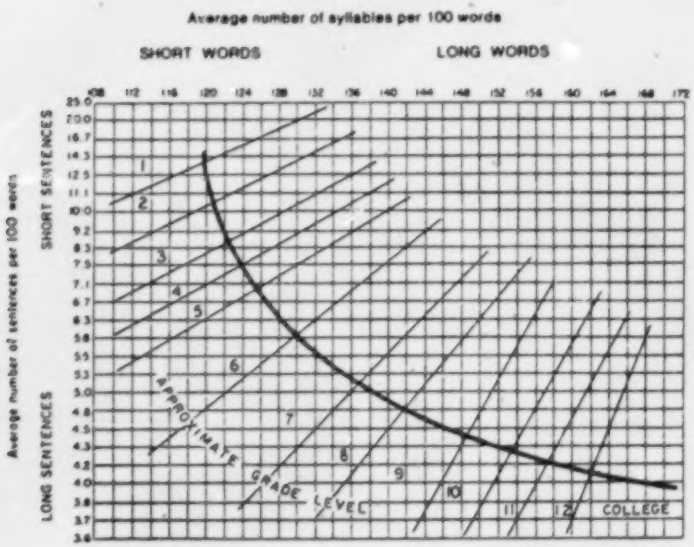
2. Divide the total number of syllables by the number of passages. This will give the average number of syllables.

3. On the Fry Graph plot the *average* number of sentences and the *average* number of syllables. The point where they intersect is the approximate readability level of the materials.

4. The approximate readability level of this material is _____.

GRAPH FOR ESTIMATING READABILITY

By Edward Fry, Rutgers University Reading Center,
New Brunswick, New Jersey



SOURCE: The Readability Graph conceived by Edward Fry, Rutgers University Reading Center, New Brunswick, New Jersey, is not copyrighted. Anyone may reproduce it in any quantity without permission from the author and editor. The Readability Graph can be found in Edward Fry, *Reading Instruction for Classroom and Clinic*, New York: McGraw-Hill Book Co., 1972, p. 232.

Sources of Free and Inexpensive Non-text Materials

A variety of free and inexpensive materials is available from voluntary, public, and professional health agencies. Below is a list of agencies that provide such materials on request.

Public Health Agencies

Department of Education
Office of Education
Washington, D.C. 20025

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20025
(Request a catalog of materials.)

U.S. Public Health Service
Department of Health and Human Services
Washington, D.C. 20201

The United Nations World Health Organization
New York, New York 10006

Voluntary and Professional Health Agencies

Alcoholics Anonymous
World Services, Inc.
Box 459
Grand Central Station
New York, New York 10017

American Cancer Society
New York City Division, Inc.
19 West 56th Street
New York, New York 10019

American Dental Association
211 East Chicago Avenue
Chicago, Illinois 60611

American Foundation for the Blind
15 West Sixteenth Street
New York, New York 10011

American Heart Association
Eastern Affiliate Office
622 Third Avenue
New York, New York 10017

American Hospital Association
840 North Lake Shore Drive
Chicago, Illinois 60611

American Lung Association
1740 Broadway
New York, New York 10019

American National Red Cross
Seventeenth and D Streets, N.W.
Washington, D.C. 20006
(Contact local chapters for materials)

American Nurses Association
2420 Pershing Road
Kansas City, Missouri 64108

American Optometric Association
243 North Lindbergh Boulevard
St. Louis, Missouri 63141

Arthritis Foundation
Suite 1101
3400 Peach Tree Road, N.E.
Atlanta, Georgia 30326

Muscular Dystrophy Association of America
810 Seventh Avenue
New York, New York 10019

National Association for Mental Health
250 West 57th Street
New York, New York 10019

National League for Nursing
10 Columbus Circle
New York, New York 10019

National Multiple Sclerosis Society
205 East 42nd Street
New York, New York 10017

National Society for the Prevention
of Blindness
79 Madison Avenue
New York, New York 10016

Planned Parenthood—World Population
810 Seventh Avenue
New York, New York 10019

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The major goal of this publication is to provide insights and instructional ideas to teachers of health, physical education, and recreation. Careful attention is given to providing practical, uncomplicated suggestions for identifying the broad categories of reading difficulty experienced by students, organizing for instruction, coping with technical or other special vocabularies, improving the understanding of written materials, developing important study skills, and selecting materials to meet student needs. In short, teachers are provided with a wide range of information designed to help them develop student reading abilities in a way that improves and sharpens their performance in school generally.

The authors of *Reading in Health Physical Education Recreation Classes* are Page S. Bristow and Alan E. Farstrup. Both are Assistant Professors in the Education Department, University of Rhode Island.

The Health Education Consultant is Ann E. Nolte, Professor, Health Education, Illinois State University, Normal. The Physical Education Consultant is Barbara D. Lockhart, Assistant Dean, College of HPERD, Temple University, Philadelphia, Pennsylvania. The Recreation Education Consultant is Joel F. Meier, Professor of Recreation Education, School of Forestry, University of Montana.

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